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TECHNICAL SPECIFICATIONS FOR INTERIM MESURE SITE PREPARATION AND  
TREATMENT FACILITY SITE 11 OLD CAMDEN COUNTY LANDFILL NSB KINGS BAY GA  
8/5/1994  
ABB ENVIRONMENTAL SERVICES, INC

# **TECHNICAL SPECIFICATIONS**

**INTERIM MEASURE SITE PREPARATION AND  
TREATMENT FACILITY  
SITE 11 - OLD CAMDEN COUNTY LANDFILL  
NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA**

**5 AUGUST 1994**

**ABB ENVIRONMENTAL SERVICES, INC.  
1400 CENTERPOINT BOULEVARD, SUITE 158  
KNOXVILLE, TENNESSEE 37932**

# IM CONVEYANCE AND TREATMENT

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**TECHNICAL SPECIFICATIONS**

*DIVISION 1*  
*GENERAL REQUIREMENTS*

## SECTION 01010

### SUMMARY OF WORK

#### PART 1 - GENERAL

##### 1.01 BACKGROUND

Results of previous site investigation activities at the Old Camden County Landfill, Site 11, at Naval Submarine Base (NSB), Kings Bay indicate that volatile organic compounds (VOC) are present within the surficial aquifer. The extent of VOC contamination within the groundwater extends off of NSB property into an adjacent subdivision. Due to the nature of the VOC contamination and its presence in the surficial aquifer beneath a residential community, an Interim Measure (IM) is necessary. Air monitoring conducted during previous work at the site has not indicated the need for respiratory protection. Results of soil vapor sampling do not suggest that VOCs will be present in the soil to be disturbed during the work associated with this scope. No conditions that are eminently threatening to human health are expected. Therefore, Level D personal protective equipment (PPE) will be required for all associated construction activities. Unanticipated site conditions discovered during routine health and safety monitoring may require an upgrade to higher levels of protection. Subcontractor will also be required to conform to OSHA 29 CFR 1910.120.

##### 1.02 PRELIMINARY ACTIVITIES

Preliminary activities to be conducted prior to the field work include arranging for acquisition of necessary permits and obtaining base security; conducting a reconnaissance of the site to determine logistics and meet with ABB Environmental Services (ABB-ES), here and after referred to as the Contractor, and Base personnel to make access and security arrangements. A preconstruction meeting with the General Subcontractor will be required two days prior to mobilization to the site. Subcontractor personnel involved in this project will also be required to attend a health and safety meeting presented by ABB-ES personnel, and be briefed on planned activities related to site preparation and the IM Conveyance and Treatment installation.

##### 1.03 SUMMARY OF WORK

Work to be completed includes grading of existing entrance road and resurfacing with limestone aggregate. Clearing and grubbing of site compound, decontamination pad and equipment pad areas. Construction of decontamination and equipment pads and PVC fencing around site compound and equipment pad. Provide purchased treatment equipment, installation of piping and all associated valves, pumps and appurtenances. Excavation and backfilling for the installation of all electrical and water services. Horizontal drilling underneath Spur 40 and the base patrol road for transferring electrical and water conveyance lines from state right-of-way property back to the treatment

facility. Installing a 3 inch diameter PVC discharge line from the treatment facility to an adjacent sanitary sewer manhole which feeds into the base Land Applications System (LAS).

END OF SECTION

## SECTION 01025

### MEASUREMENT AND PAYMENT

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Summary of Work: Section 01010

##### 1.02 SCOPE OF PAYMENT

- A. Payments to the Subcontractor will be made in accordance with the provisions of the Contract Conditions.
- B. The Subcontractor shall accept in compensation for each pay item, as full payment to furnish all materials, labor, tools, equipment, and incidentals necessary to complete work; for performing all work contemplated and embraced by the Contract; for all loss or damage, through negligence of the Subcontractor, arising from the nature of the work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the execution of the work and until its final acceptance by the Resident Engineer; and for all expenses incurred in consequence of the suspension of the work except as specified in the Contract Conditions.
- C. No extra payment will be made to the Subcontractor for any expense or delays caused by inadequate work, lack of progress, defective workmanship, or rescheduling of work by other subcontractors, or equipment and material suppliers.

##### 1.03 INCIDENTAL WORK

- A. Incidental work items for which separate payment is not measured include, but are not limited to, the following items:
  - 1. Office and material storage facilities.
  - 2. Sanitary facilities and trash removal.
  - 3. Signs, barricades, and warning lights.
  - 4. Restoration of disrupted areas not designated on the Drawings.
  - 5. Cooperation with other Subcontractors and others.
  - 6. Mobilization and demobilization of equipment.

1.04 DESCRIPTION OF PAY ITEMS

- A. The following pay items describe the measurement of and payment for the work to be done under the respective items listed in the Bid.
- B. Each unit or lump sum price stated in the Bid shall constitute full compensation, as herein specified, for each item of the completed work.

1.05 PAY ITEMS

Item No. 1 - Treatment System and Site Work

A. Method of Measurement:

- 1. Lump sum for purchased items, including labor.

B. Lump Sum Payment: Payment shall be made at the contract lump sum price which shall be full compensation for all labor, equipment and tools required for completing site compound, decontamination area, treatment compound, installation of the conveyance lines and treatment system. Site utility installation will include electric service, water, and lighting to the treatment and site compound areas. Pay requests shall be submitted for the following unit payments:

- 1. General Conditions: Including but not limited to mobilization and demobilization cost.
- 2. Site Work: Including but not limited to clearing, grubbing, excavation and backfill, fencing and road improvements.
- 3. Concrete Work: Including but not limited to installation of treatment compound pad and decontamination pad.
- 4. Electrical and water services.
- 5. Equipment: Payment of lump sum quantities shall be provided for the purchase of the following equipment and associated appurtenances (equipment not specifically addressed here shall be identified as purchases):

B-01	Blower
B-02	Carbon ID Fan
C-01	Carbon Unit
E-01	Preheater
Control Panel	
P-03	Effluent Pump

P-05 Treatment Pad Sump Pump  
P-07 Decontamination Pad Sump Pump

P-01A → P01G Extraction Pumps, 6 Units  
T-01 Pretreatment Tank  
S-02 Low Profile Air Sparger

Bioreactor System

Influent Pump  
Nutrient Delivery System  
pH Control System  
Methane/Oxygen Control System Components  
Flow Meter System  
Water Heater System

5. Equipment: Payment of the lump sum shall be provided for the installation and connection of all equipment for the treatment system.
6. Mechanical: Including but not limited to all piping, valves, tanks and connection hardware for conveyance and treatment system installation. Payment shall be provided for purchased materials. Separate pay requests will be submitted for installation of the materials. This includes trenching and horizontal drilling, and repair of areas due to installation of conveyance and treatment systems.
7. Electrical: Including but not limited to installation and materials of all electrical components necessary for the conveyance and treatment system. Separate payment will be provided for material purchases and for installation.

1.06 BID SUBMITTALS

- A. Bid submittals shall encompass all necessary labor, equipment, materials, and general conditions necessary for the performance of the work identified in the Specifications and Drawings.
- B. Lump Sum Bids shall be provided for all work associated with the following divisions, in accordance with these Specifications and Drawings.
  1. General Conditions: Including but not limited to mobilization and demobilization.
  2. Site Work: Including but not limited to clearing, grubbing, excavations, backfill, road improvements and fencing. Submit as a deduct item 20 cubic

yards of clean fill material void of rocks greater than 1.5 inch and organic material. Trenching for conveyance system and discharge system installation should be submitted under Division 15 - Mechanical.

3. Concrete Work: Including but not limited to installation of decontamination pad and treatment compound pad.
4. Exterior water service.
5. Equipment: Include bid schedule for each item listed. If equipment is not specifically addressed here and is necessary for the extension of the work, it shall be identified, listed, and assumed as purchased:

B-01	Blower
B-02	Carbon ID Fan
C-01	Carbon Unit
E-01	Preheater
Control Panel	
P-03	Effluent Pump
P-05	Treatment Pad Sump Pump
P-07	Decontamination Pad Sump Pump
P-01A → P01G	Extraction Pumps, 6 Units
T-01	Pretreatment Tank
S-02	Low Profile Air Sparger

Bioreactor System

Influent Pump  
Nutrient Delivery System  
pH Control System  
Methane/Oxygen Control System Components  
Flow Meter System  
Water Heater System

5. Equipment: (labor, incidentals, etc.) including but not limited to the installation and connection of all equipment for the treatment system.
6. Mechanical: Provide lump sum bid that provides for itemization of materials as a line item, and labor and incidentals necessary for the installation of the conveyance system. Include in this section all mending, road repair, and horizontal drilling necessary for the work as specified in the Specifications and Drawings.

7. Electrical: Provide lump sum bid that provides for itemization of materials as a line item, and labor and incidentals necessary for all electrical work necessary for the site compound and treatment system.

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Subcontractor to coordinate all work under this Contract, with the ABB-ES Resident Engineer.
- B. Make arrangements for temporary storage of materials and supplies and for the timely delivery to the job site.
- C. Maintain up to date progress records and record drawings.
- D. Maintain the project site in a neat condition.
- E. Submit utility connection request to Naval Submarine Base Code N522 for approval and coordination. Point of Contact - Ralph E. Reeves, Ext. 4650.
- F. Coordinate the work of subcontractors, equipment, and material suppliers.
- G. Project work must not interfere with the Naval Submarine Base activities.
- H. Prior to commencing work on site, coordinate with the Resident Engineer and the Kings Bay Naval Subbase for access routes and procedures to be followed.
- I. Facilitate the Subcontractor's right-of-access to all locations through the Project Client and the NSB Command.
- J. Designate parking, equipment storage, and equipment decontamination areas.

END OF SECTION

SECTION 01091

REFERENCE CODES AND STANDARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Comply with local, state, and national codes applicable to the proposed construction including but not limited to the following.

1. OSHA - National Occupational Safety and Health Act.
2. BOCA - Building Officials and Code Administrators - "Basic Building Code."
3. Associated General Contractors of America - "Manual of Accident Prevention in Construction."
4. U.S. Army Corp of Engineers Safety and Health Requirements Manual, EM385-1-1.
5. National Electrical Code.
6. National Fire Protection Association.

B. Applicable standards, tests and recommended methods from trade, industry and professional organizations specified in technical specifications of this Contract determine quality and methods of design, fabrication and testing.

1.02 EDITION DATES

A. Edition dates of standards and codes specified in this Contract shall be that which are current as of the Bid date or date of Contractor-Subcontractor Agreement when there are no bids.

END OF SECTION

## SECTION 01125

### SPECIAL PROJECT PROCEDURES

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Site Maintenance: Section 01710.
- B. Project Record Documents: Section 01721.

##### 1.02 SUBCONTRACTOR'S CERTIFICATION

- A. Certify in writing that all employees working pursuant to this contract are properly trained for this type of work.
- B. This certification shall state that:
  - 1. All employees are current in their training for that level required by their job function and responsibility, as required by 29 CFR part 1910.
  - 2. The individual who signs the certification of training on behalf of the Subcontractor has the Subcontractor's authority to certify that this training information is accurate and complete.
  - 3. The Subcontractor agrees to abide by all applicable federal, state, and local laws and regulations.

##### 1.03 SUBCONTRACTOR'S RESPONSIBILITIES

- A. Subcontractor shall provide all necessary personnel, equipment, and materials to perform the work. The following are also required:
  - 1. Subcontractor shall provide all medical monitoring, training, certification, and health and safety equipment for Subcontractor personnel as required in the Contractor Health and Safety Plan (HASP) and the NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. It is understood that the Subcontractor shall perform all on-site services at a level of safety that is equivalent at or exceeds the level of safety established in the Contractor HASP. The Contractor HASP will be available for review at the site prior to construction activities.

2. Subcontractor shall be subject to security clearance procedures set forth in section 1.06 of this specification.
  3. Subcontractor personnel shall attend an initial health and safety briefing and obtain necessary Naval Submarine Base security badges on the first day of work. It is anticipated that the IM site preparation and treatment system activities will take approximately 5 months to complete.
  4. Anticipated start date for mobilization is 10 September 1993.
  5. Provide a daily authorized site representative responsible for all Subcontractor work. The representative will meet at least twice a week with the Resident Engineer.
- B. The methods, procedures and techniques to be used by the Subcontractor are the responsibility of the Subcontractor, and shall be designated to meet the intent of the technical specifications herein.

#### 1.04 CONTRACTOR'S RESPONSIBILITIES

Contractor, or on-site engineer (resident engineer), will provide the following services:

- A. Coordinate all work to be completed by Subcontractor.
- B. Observe the Subcontractor's activities as required.
- C. Consider written requests on the part of the Subcontractor to charge standby time for delays resulting from actions of Contractor or the NSB Kings Bay Command. Contractor will determine the merits of such requests and, when warranted, approve standby time in writing.

#### 1.05 HEALTH AND SAFETY REQUIREMENTS

- A. In performance of the work, Subcontractor shall, as a minimum, satisfy all federal, state and local statutes, regulations and ordinances regarding health and safety, including, but not limited to, OSHA 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response, Final Rule, U.S. Department of Labor, Occupational Safety and Health Administration, March 1990. These included: a requirement that all on-site personnel receive a minimum of 40 hours of formal hazardous waste safety training. Subcontractor must submit a certification to Contractor stating that each of its employees working on-site is in a Medical Monitoring program and has completed the appropriate training and field experience in compliance with regulations before the field work begins. Subcontractor shall also comply with the Health and Safety Plan developed by Contractor for the site.

- B. Subcontractor shall be and remain solely responsible and liable for compliance by its employees, agents and subcontractors with the Health and Safety Plan and procedures for the site, and shall hold Contractor harmless from all claims, damages, suits, losses, and expenses including suits by its employees in any way arising from non-compliance with the Health and Safety Plan.
- C. The minimum requirements for a Health and Safety Plan (HASP) during the previous programs has been developed by Contractor based on the information currently available to it and will be supplied to Subcontractor before field activities begin. Based on what Contractor currently knows about the potential for chemical exposure to personnel at the site, it is expected that the work in this program will require Level D protection.
- D. U.S. Army Corp of Engineers Safety and Health Requirements Manual, EM385-1-1.

#### 1.06 SECURITY REQUIREMENTS FOR SUBCONTRACTOR PERSONNEL

In addition to any other requirements set forth in this Subcontract or required by the installation, Subcontractor shall be responsible for providing the following information to Contractor so that arrangements may be made to facilitate access to the installation:

- A. The full name of any Subcontractor personnel who will require access to the facility
- B. Date of birth
- C. Places of birth
- D. Social security numbers
- E. Citizenship

Additionally, please be advised that vehicle registrations and proof of insurance must be provided by Subcontractor for any vehicles owned or operated by Subcontractor which will require access to the installation.

#### 1.07 REFERENCES

- A. Occupational Safety and Health Administration (OSHA) Standards. Title 29, Code of Federal Regulations, Part 1910 and 1926 (29 CFR 1910 and 1926).
- B. United States Environmental Protection Agency, "Standard Operating Safety Guides," November, 1984. Corps of Engineer Safety Manual.

C. The most stringent requirement among these references shall apply.

END OF SECTION

SECTION 01151

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Special Project Procedures: Section 01125
- B. Site Maintenance: Section 01710

1.02 DESCRIPTION

- A. Work Included:
  - 1. Provide such temporary facilities as the work may warrant.
  - 2. Facilities include, but are not limited to:
    - a. Subcontractor's office and storage facilities.
    - b. Sanitary facilities conforming to local codes and OSHA requirements.
    - c. Trash containers.
    - d. Personal safety equipment.
    - e. Signs, barricades, and warning lights.
  - 3. Upon completion of the work, completely remove all Subcontractor installed temporary facilities at the site. Repair all damage caused by the installation.
  - 4. Make all necessary arrangements for electricity, water, sanitary waste, and other utilities. Electricity will be made available at the site by the Subcontractor. The Subcontractor is responsible for providing a service pole and meter socket if utility power is used. The Subcontractor is responsible for providing decontamination water, drinking water, and water for any other uses.

## 1.03 SANITARY FACILITIES

### A. Sanitary Conveniences:

1. Provide chemical type toilets and maintain in sufficient numbers, for the use of all persons employed on the job, and properly screen from public observation, at suitable locations, in accordance with State and Local ordinances.
  - a. Empty periodically as required and disposed of in a timely manner satisfactory to the Resident Engineer.
  - b. When no longer required, remove from the site and dispose of the contents in a manner satisfactory to the Resident Engineer.

END OF SECTION

## SECTION 01340

### SHOP DRAWINGS, PROJECT DATA, SAMPLES, AND SUBMITTALS

#### PART 1 - GENERAL

##### 1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Project Record Documents: Section 01721

##### 1.02 DESCRIPTION

- A. Submit to Resident Engineer:
  - 1. Shop Drawings
  - 2. Operation and Maintenance Manuals
  - 3. Manufacturer's Certificates
  - 4. Project Data
  - 5. Samples required by the Contract Documents.
- B. Prepare and submit a schedule listing dates for submission of each product.

##### 1.03 SHOP DRAWINGS

- A. All costs necessary for compliance with requirements of this Section of Specifications shall be incidental to bid items under which each material and piece of equipment is paid for.
- B. Detailed Shop Drawings, data, and literature for fabricated materials or equipment to be incorporated in work shall be submitted to Resident Engineer for review for general compliance with Contract Documents before fabrication. Subcontractor shall obtain and check manufacturer's Shop Drawings, certified prints, and other pertinent data for conformance with all requirements of Contract Documents in ample time to permit satisfactory progress of work. After completion of such checking and verification, Subcontractor shall sign or stamp such drawings, which stamp shall state as follows:

Checked by

\_\_\_\_\_  
(Subcontractor's Name)

Signed by

\_\_\_\_\_  
(Checker's Name)

All data, drawings, and correspondence from subcontractors, manufacturers, or suppliers shall be routed through Subcontractor. Resident Engineer shall review only such data and details as are transmitted to him by Subcontractor. All correspondence from Subcontractor to Resident Engineer shall refer to appropriate Section of these Specifications containing subject matter of inquiry.

- C. Subcontractor's attention is specifically directed to fact that Shop Drawings are required for each and every element of work. Each Shop Drawing shall be assigned a sequential number for purposes of easy identification, and shall retain its assigned number, with appropriate subscript, on required resubmissions. Equipment shall be identified by number shown on Drawings, Schedules and Specifications.
- D. All Shop Drawings shall be in conformity with all requirements of Contract Documents. All Shop Drawings, except diagrams, brochures, schedules, and illustrations shall be to an appropriate scale, no smaller than  $\frac{1}{4}$  inch = 1 foot 0 inches, and shall give all dimensions necessary for installation and incorporation in work. All Shop Drawings shall be accurate and complete, showing outline and section views, details, materials, accessories, appurtenances and related items. Shop Drawings showing piping and conduit systems shall incorporate sufficient views to show all fittings and specialties including locations and spacing of hangers and supports. Piping and/or conduit systems 3 inches in diameter and smaller may be shown as single line. Equipment and specialties installed within and/or connected to piping and conduit systems shall be cross-referenced to equipment and specialty Shop Drawings by Shop Drawing identification number, manufacturer name, catalog or model number, and equipment numbers as shown on the Drawings or as specified herein.
- E. Electrical Shop Drawings shall include, but are not necessarily limited to, complete terminal identification diagrams and schedules, complete point-to-point interconnection diagrams, complete single line and elementary wiring diagrams, for all power, signal, control and lighting systems, together with panel layout drawings. Terminal point and wire identification on all working drawings shall be identical to related terminal point and wire identifications on equipment and panels, and absolutely no deviation from this requirement will be permitted.

- F. Subcontractor shall submit to Resident Engineer 4 copies (or more as Subcontractor may require for his own distribution) and 1 Sepia of Shop Drawings and approved data. The Resident Engineer will retain [3] copies of each submittal and return the additional copies to the Subcontractor. The Resident Engineer's notations of the action taken will be noted on all of the returned copies. At the time of each submission, the Subcontractor shall call to the Resident Engineer's attention, in writing, any deviations that the Shop Drawings may have from the requirements of the Contract Documents.

A maximum of 2 submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Subcontractor. Any additional submissions which are ordered by the Resident Engineer to fulfill the stipulations of the Contract Documents, and which are required by virtue of the Subcontractor's neglect or failure to comply with the requirements of the Contract Documents, will be reviewed and checked as deemed necessary by the Resident Engineer, and cost of such review and checking, as determined by Contractor, and based upon a rate of \$55.00 per hour, will be deducted from Subcontractor's monthly invoices or from monies retained under the provisions of Contract Documents. It is therefore incumbent upon Subcontractor to make all modifications and/or corrections as may be required by Resident Engineer in an accurate, complete, and timely fashion.

- G. Upon review by the Resident Engineer of above Drawings, lists, samples, and other data, the same shall become a part of the Contract, and the fabrications furnished shall be in conformity with same. Review of above Drawings, lists, specifications, samples, or other data, however, shall in no way release Subcontractor from his responsibility for proper fulfillment, by any fabrication, of requirements of this Contract.
- H. Corrections or comments made on Shop Drawings during Resident Engineer's review do not relieve Subcontractor from compliance with requirements of Contract Documents. This check is only for review of general conformance with design concept of Project and general compliance with information given in Contract Documents. Subcontractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; and in performing his work in a safe manner. If Shop Drawings deviate from Contract Documents, Subcontractor shall advise Resident Engineer in writing of deviations accompanying Shop Drawings, including reasons for deviations, and shall request a deviation from Contract Documents.
- I. Shop Drawings are intended to be utilized by Subcontractor for additional fabrication, assembly, and erection data. Shop Drawings do not change or supersede Drawings and Specifications except in specific cases when Subcontractor requests in writing and receives approval in writing for a deviation from Drawings and Specifications. Subcontractor's request for a change shall

give, in detail, specific change requested and shall state reason for change. Changes requested by Subcontractor and approved by Resident Engineer shall not be construed to include approval of any change except changed details specifically requested and approved.

- J. Subcontractor shall also submit to Resident Engineer, for review with such promptness as to cause no delay in work, all samples required by Contract Documents. All samples will have been checked by and stamped with approval of Subcontractor, identified clearly as to material, manufacturer, any pertinent catalog numbers, and use for which intended.
- K. Subcontractor's attention is specifically directed to fact that no work shall be fabricated, nor equipment or materials ordered, nor any construction performed, prior to approval by Resident Engineer of Shop Drawings applicable thereto. Construction performed in violation of this requirement will be neither approved nor certified for payment until applicable Shop Drawings have been submitted and approved. If Resident Engineer so directs, Subcontractor shall disassemble and remove any such construction performed prior to approval by Resident Engineer of Shop Drawings applicable thereto, and Subcontractor will be allowed no additional compensation nor extension of contract time. If any equipment or materials are ordered by Subcontractor prior to submission and approval of Shop Drawings, it is done at Subcontractor's risk.
  - 1. Subcontractor is responsible for making necessary changes in other items, which result from deviations or changes requested by the Subcontractor and approved by Resident Engineer, so that all items perform requirements and intent of Contract Documents.
- M. Shop Drawings shall be of standardized sizes to enable the Contractor to maintain a permanent record of submissions.
  - 1. Approved standard sizes shall be:
    - a. 24 inches by 36 inches
    - b. 11 inches by 17 inches
    - c. 11 inches by 8 1/2 inches.
  - 2. Provision shall be made in preparing Shop Drawings to provide a binding margin on left hand side of sheet.
  - 3. Shop Drawings submitted other than as specified herein may be returned for resubmittal without being reviewed.

#### 1.04 OPERATION AND MAINTENANCE MANUALS

- A. Subcontractor shall furnish Resident Engineer 6 copies of a complete instruction manual for installation, operation, maintenance, and lubrication of each item of equipment or system specified.
  - 1. Manual shall be submitted in accordance with requirements specified herein when shop drawings are submitted.
- B. Manuals shall include operating and maintenance information on all systems and items of equipment. Data shall consist of catalogs, brochures, bulletins, charts, schedules, equipment numbers, Shop Drawings corrected to as-built conditions, wiring diagrams, and Assembly Drawings which shall describe location, operation, maintenance, lubrication, operating weight, lubrication charts showing manufacturer-recommended lubricants for each rotating or reciprocating unit, and other necessary information for Resident Engineer to establish a complete maintenance program.
- C. Submittal shall also include details of all replacement parts.
  - 1. "Nameplate" data for all equipment.
  - 2. Detailed instructions for start-up.
  - 3. Normal operation, shutdown procedures, and control techniques.
  - 4. Guide for troubleshooting system.

#### 1.05 MANUFACTURER'S CERTIFICATES

- A. Prior to accepting installation, Subcontractor shall submit manufacturer's certificates for each item specified.
- B. Such manufacturer's certificates shall state that:
  - 1. Equipment has been installed under either continuous or periodic supervision of manufacturer's authorized representative.
  - 2. It has been adjusted and initially operated in presence of manufacturer's authorized representative.
  - 3. It is operating in accordance with specified requirements, to manufacturer's satisfaction.
- C. All costs for meeting the above stated requirement shall be included in Subcontractor's bid price.

## 1.06 PROJECT DATA

- A. Manufacturer's Standard Schematic Drawings:
  - 1. Modify Drawings to delete information which is not applicable to project.
  - 2. Supplement standard information to provide additional information applicable to project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data.
  - 1. Clearly mark each copy to identify all pertinent materials, products or models, or information.
  - 2. Show dimensions and clearances required.
  - 3. Certify performance characteristics and capacities.
  - 4. Show wiring diagrams and controls.

## 1.07 SUBCONTRACTOR RESPONSIBILITIES

- A. Review Shop Drawings, Project Data, and Samples prior to submission.
- B. Samples:
  - 1. Field measurements.
  - 2. Field construction criteria.
  - 3. Catalog numbers and similar data.
- C. Coordinate each submittal with requirements of work and of Contract Documents.
- D. Subcontractor's responsibility for errors and omissions in submittals is not relieved by Resident Engineer's review of submittals.
- E. Subcontractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Resident Engineer's review of submittals, unless Resident Engineer gives written acceptance of specific deviations.
- F. Notify Resident Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.

- G. Begin work which requires submittals after return of submittals with Resident Engineer's stamp and initials or signature indicating review and approval.
- H. After Resident Engineer's review, distribute copies.

1.08 SUBMISSION REQUIREMENTS

- A. Schedule submissions at least 5 days before dates reviewed submittals will be needed, except where longer lead time is specified.
- B. Submit the number of Samples specified in each of the Specification Sections.
- C. Accompany submittals with transmittal letter (see attached form supplied by the Resident Engineer), in duplicate, containing:
  - 1. Date.
  - 2. Project title and number.
  - 3. Subcontractor's name and address.
  - 4. The number of each Shop Drawing, Project Data and Sample submitted.
  - 5. Notification of deviations from Contract Documents.
  - 6. Return date required by Subcontractor.
  - 7. Other pertinent data.
- D. Submittals shall include:
  - 1. Date and revision dates.
  - 2. Project title and number.
  - 3. The names of:
    - a. Resident Engineer.
    - b. Subcontractor.
    - c. Subcontractors.
    - d. Supplier.
    - e. Manufacturer.
    - f. Separate detailer when pertinent.
  - 4. Identification of product or material.
  - 5. Relation to adjacent structure or materials.
  - 6. Field dimensions, clearly identified as such.
  - 7. Specification section number.
  - 8. Applicable standards, such as ASTM number or Federal Specification.
  - 9. A blank space, 4 inches by 4 inches, for Resident Engineer's stamp.
  - 10. Identification of deviations from Contract Documents.
  - 11. Subcontractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents.

12. Manufacturers Certificate of Compliance for manufactured or fabricated materials. See attached form.

E. Mail to:

Tracey L. Keel  
Resident Engineer  
Naval Submarine Base  
Kings Bay, Georgia 31547

#### 1.09 RESUBMISSION REQUIREMENTS

A. Shop Drawings:

1. Revise initial Drawings as required and resubmit as specified for initial submittal.
2. Indicate on Drawings any changes which have been made other than those requested by Resident Engineer.

- B. Project Data and Samples: Submit new data and samples as required for initial submittal.

#### 1.10 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

- A. Distribute copies of Shop Drawings and Project Data which carry Resident Engineer's signature, to the following as applicable.

1. Subcontractor's file.
2. Job site file.
3. Record Documents file.
4. Other prime contractors.
5. Subcontractors.
6. Supplier.
7. Fabricator.

- B. Distribute samples as directed.

#### 1.11 RESIDENT ENGINEER'S DUTIES

- A. Review submittals with reasonable promptness.

- B. Review for:
  - 1. Design concept of project.
  - 2. Information given in Contract Documents.
- C. Review of separate item does not constitute review of an assembly in which item functions.
- D. Affix stamp and initials or signature indicating review of submittal.
- E. Return submittals to Subcontractor for distribution.

END OF SECTION

(Sample)  
**MANUFACTURER'S LETTERHEAD  
CERTIFICATE OF  
COMPLIANCE**  
(Manufactured or Fabricated Material)

Date \_\_\_\_\_

WE HEREBY CERTIFY that \_\_\_\_\_  
(Description, Kind of Material, Model No., etc.)

Furnished to \_\_\_\_\_  
(Name of Subcontractor) (Prime or Sub.)

For Use On \_\_\_\_\_  
(Project Name)

No. \_\_\_\_\_ Owner \_\_\_\_\_

In the Amount of \_\_\_\_\_  
(Quantity Represented)

Identified By \_\_\_\_\_  
(Label, Marking, Seal No., Consignment, or Waybill No.)

Shipped on \_\_\_\_\_ 19\_\_\_\_, Delivered on \_\_\_\_\_ 19\_\_\_\_,

Shipped Via \_\_\_\_\_  
(Method of Shipment, Car No., Truck No.)

MEETS THE REQUIREMENTS OF THE PERTINENT PROJECT PLANS, SPECIAL CONDITIONS AND SPECIFICATIONS OF THE SUBJECT PROJECT IN ALL RESPECTS. PROCESSING, PRODUCT TESTING AND INSPECTION CONTROL OF RAW MATERIALS ARE IN CONFORMANCE WITH ALL APPLICABLE SPECIFICATIONS, DRAWINGS AND/OR STANDARDS OF ALL ARTICLES FURNISHED.

All records and documents pertinent to this certificate and not submitted herewith will be maintained available by the undersigned for a period of not less than three years from the date of this certificate.

\_\_\_\_\_  
(Manufacturer)

Signed by \_\_\_\_\_

Title \_\_\_\_\_

## SECTION 01600

### MATERIAL CONTROL

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This Section covers packing and shipping, receiving, unloading, examining, and storage of materials and equipment to be installed in this Project.
- B. Package, ship, receive, inspect, handle, and store materials and equipment in a manner that will protect such items from damage or deterioration.

##### 1.02 PACKING AND SHIPPING

- A. Suppliers' preparation of equipment shall be suitable for long term storage in the climate at the site and be such that preventative maintenance is not required during storage.
- B. Identify all desiccants and inhibitors used and the required replacement frequency.
- C. Any internal bracing required only for shipping purposes shall be marked to indicate the proper sequence of its removal prior to operation.
- D. The outermost covering shall be clearly marked with the complete Supplier identification, including weight.
- E. Boxes and crates shall be equipped with skids.
- F. Indicate the weight, lifting points, and/or center of gravity on the crate, skid, or package and utilize those indications for all handling procedures.
- G. Obtain from the Supplier:
  - 1. One set of any special wrenches, tools, fixtures, slings, lifting devices, and appurtenances necessary or convenient for erection, installation or maintenance of the equipment.

##### 1.03 RECEIPT AND UNLOADING

- A. Handle material and equipment in accordance with these specifications and any manufacturer's handling precautions that may be applicable to specific materials and equipment.

- B. Supply and use all specialized equipment, such as nylon slings or special hoisting equipment, where appropriate or required.

#### 1.04 ACCEPTANCE AT SITE

##### A. General:

1. Examine all materials and equipment upon arrival.
2. Damaged or nonconforming items shall be removed immediately to a separate storage area for expeditious removal from the site.

#### 1.05 STORAGE AND PROTECTION

##### A. General:

1. Provide open and closed storage areas for equipment and materials for protection from vandalism and weather damage.
2. Store materials and equipment in accordance with these specifications and any manufacturer's instructions for additional storing precautions that may be applicable to specific materials and equipment.
3. Store materials and equipment on blocking or pallets a sufficient distance above the ground or floor to protect from mud, standing or flowing water or similar hazards. Use waterproof covers on storage outdoors.
4. Provide indoor storage or heated indoor storage for material and equipment that normally require such protection.

END OF SECTION

## SECTION 01710

### SITE MAINTENANCE

#### PART 1 - GENERAL

##### 1.01 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

- A. Summary of Work: Section 01010.

##### 1.02 DESCRIPTION

- A. Maintain premises free from accumulations of waste, debris, and rubbish, caused by operations.
- B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all sight-exposed surfaces.
- C. At completion of work, remove Subcontractor equipment and materials from the site.

##### 1.03 SAFETY REQUIREMENTS

- A. Standards: Maintain project in accordance with following safety and insurance standards:
  - 1. Manual of Accident Prevention in Construction - AGC.
  - 2. U.S. Army Corp of Engineers Safety and Health Requirements Manual, EM385-1-1.
- B. Hazards Control:
  - 1. Prevent accumulation of wastes which create hazardous conditions.
  - 2. Provide adequate ventilation during use of volatile or noxious substances.
- C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
  - 1. Do not burn rubbish and waste materials on Naval Subbase property. Non-hazardous materials will be disposed in an approved off-base landfill.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
3. Do not dispose of wastes into streams or waterways.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

## PART 3 - EXECUTION

### 3.01 DURING CONSTRUCTION

- A. Execute cleaning to ensure that the site is maintained free from accumulations of waste materials and rubbish.
- B. At reasonable intervals during progress of work, clean site, and dispose of waste materials, debris, and rubbish. Resident Engineer may require additional cleaning if in his/her opinion it is needed.
- C. Provide on-site containers for collection of waste materials, debris, and rubbish.
- D. Remove waste materials, debris and rubbish from site and legally dispose of at a permitted public or private disposal facility off Base property.
- E. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

### 3.02 FINAL CLEANING

- A. In preparation for substantial completion, conduct final inspection of site.
- B. Maintain cleaning until project is substantially complete.

- C. Resident Engineer will make final determination of site cleanliness and Subcontractor will continue to clean site to satisfaction of Resident Engineer.

END OF SECTION

## SECTION 01721

### PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Keep accurate record documents for all additions, substitution of material, variations in work, and any other revisions to the Contract Documents.

##### 1.02 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintain at job site, one copy of:
  - 1. Contract Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders.
  - 5. Other Modifications to Contract.
  - 6. Health and Safety Plan.
  - 7. Subcontractor's Certifications.
  - 8. Progress payment quantity field notes and records.
  - 9. Subcontractor's daily reports, including:
    - a. Records of all site work.
    - b. Inspection records.

##### 1.03 SUBMITTALS

- A. At completion of construction, the Subcontractor shall deliver a copy of all documents pertaining to construction activities to the Resident Engineer.
- B. Accompany submittal with transmittal letter containing:
  - 1. Date.
  - 2. Project title and number.
  - 3. Subcontractor's name and address.

4. Certification that each document as submitted is complete and accurate.
  5. Signature of Subcontractor, or Subcontractor's authorized representative.
- C. Documents must be submitted to the Resident Engineer at project completion as a condition of final payment.

#### 1.04 RECORDING

- A. Clearly label each document "PROJECT RECORD."
- B. Keep record documents current.
- C. Contract Drawings: Legibly mark to record actual construction as applicable:
  1. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  2. Field changes of dimension and detail.
  3. Changes made by Change Order or Field Order.
  4. Details not on original Contract Drawings.
- D. Specifications and Addenda shall be legibly marked up to record changes made by change or field orders, or other matters not originally specified.

END OF SECTION

*DIVISION 2*

*SITE WORK*

SECTION 02016

EXISTING UTILITIES AND UNDERGROUND STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Inform and receive approval (permit, if necessary) from the Naval Subbase Code N522 prior to excavation anywhere, especially in areas where it is reasonable to expect the presence of existing utilities, whether shown on the Drawings or not. Point of Contact: Ralph E. Reeves, Ext. 4650.
- B. Subcontractor shall be responsible for locating and protecting all utilities within and adjacent to the work area, parking and storage areas.
- C. Subcontractor shall be responsible for any and all damage to any existing utilities, caused by his efforts.
- D. Contact the Resident Engineer as soon as any damage is uncovered.
- E. The Resident Engineer shall make the determination as to who makes the necessary repairs.
- F. In areas where existing underground structures are shown or suspected, carefully uncover such structures to such extent as to enable the Resident Engineer to determine what adjustments if any need to be made to accommodate the presence or removal of such structures.
- G. Subcontractor shall make all efforts necessary to immediately repair any and all damage caused by his/her efforts prior to continuing regular contract work.

END OF SECTION

## SECTION 02049

### SEEDING

#### 1.0 GENERAL

- A. Procurement and placement of seed and mulch will be the Subcontractor's responsibility.
- B. Seed and mulch must be placed within seven days of completion of any excavated area.
- C. Seeding will be permitted only from March 1 to October 1. The prime seeding periods are March 1 to May 1 and August 1 to September 1.

#### 2.0 PRODUCTS

##### 2.1 SEED

- A. General:
  - 1. Fresh, clean and new crop seed included in following varieties and proportioned by weight.
- B. Seeding:
  - 1. Applied as follows:

Bahia	70%
Millet	20%
Common Bermuda	10%

##### 2.3 FERTILIZER

- A. Commercial type, uniform in composition, free flowing, conforming of State and Federal laws, and suitable for application with equipment designed for that purpose.

##### 2.4 MULCH FOR SEEDED AREAS

- A. Air-dried wheat, barley, oat or rye straw substantially free of noxious weed seeds and objectional foreign matter.

### 3.0 EXECUTION

#### 3.1 PREPARATION

- A. Topsoil: Scarify subsoil to depth of 1 inch for bonding with topsoil.
- B. Seeding: Do not seed on saturated or frozen soil
- C. Mulching:
  - 1. Mulch immediately after seeding operations.
  - 2. Mulch entire surface to receive seeding.

#### 3.2 PERFORMANCE

- A. Finish Grading:
  - 1. Grades not otherwise indicated are uniform levels or slopes between points where elevations are given.
  - 2. Grade, rake, and roll with roller.
  - 3. Maximum allowable variation from correct elevation is 2 inches in 10 feet.
  - 4. Remove rocks or other material that will interfere with seed bed preparation.
- B. Seeding:
  - 1. Work fertilizer and lime (if needed for pH adjustment) into the soil to a depth of 3 to 4 inches with a harrow, disk or other tillage tool. Operate across the slope as much as possible.
  - 2. Sow seed at an acceptable rate, dividing seed equally and sowing at 90° angles to produce uniform broadcast.
  - 3. Rake seed into ground and roll with a cultipacker across slopes as much as possible.
  - 4. If a Brillion seeder is used, seed may be sown in one operation and raking and rolling operations after seeding may be omitted, except in areas inaccessible to seeder.

5. Method of seeding may be varied at the discretion of the Subcontractor on his own responsibility to establish smooth, uniform turf composed of specified grasses.
6. Do not seed following rain or if surface has been compacted by rain.
7. Do not seed when wind velocity exceeds 6 mph.

C. Mulching

1. Unless otherwise directed, mulch immediately after seeding has been completed.
2. Spread uniformly at a rate of 2 tons per acre.
3. Place mulch loose or open enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade ground, conserve soil moisture, and prevent or reduce erosion.
4. Do not mulch during periods of excessively high winds which would preclude proper placing of mulch.
5. Place double mulch on the upper 3 feet of all sideslopes to reduce rill formation.
6. Crimp mulch into topsoil with a straw crimper driven perpendicular to the slope for a contoured effect.

3.3 WATERING

- A. Water shall be applied immediately after final placement of the seed and mulch. Watering shall be at the rate of 10,000 gallons per acre or as directed by the Resident Engineer. The Subcontractor shall provide satisfactory means for an even distribution of water at the specified rate, and in a manner that will prevent erosion due to application of excessive quantities. The watering equipment shall be of a type to prevent damage to the finish surface.
- B. When any portion of the surface becomes gullied or otherwise damaged after planting and before acceptance, the affected portion shall be repaired to re-establish the condition and grade of the soil prior to injury and re-planted at the Subcontractor's expense.

3.4 MAINTENANCE

- A. Maintenance shall begin immediately following last completion of seeding and mulching. Continue until the Work is accepted by Resident Engineer.
- B. Seeded areas shall be maintained by watering until vegetation has sufficiently progressed. Maintenance will also include mowing and replanting as may be necessary to produce uniform stand of grass until the Work is accepted.

END OF SECTION

## SECTION 02102

### CLEARING AND GRUBBING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Work Included:

1. Clearing and grubbing work, when applicable, includes but is not limited to, removal of trees, brush, stumps, wooded growth, grass, shrubs, and other vegetation and minor structures.
2. Protection of designated wooded growth.
3. Disposal of nonsalvagable structures and materials.

###### B. Limits of Work:

1. Perform work within the areas required for construction or as shown on the Drawings.

###### C. Work Not Included: Clearing and/or grubbing work performed for the convenience of the Subcontractor will not be considered for payment.

##### 1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Dispose of combustible material by burning is not permitted.
- B. Remove and dispose of nonsalvagable structures and material in accordance with all applicable local and state laws, ordinances, and code requirements.

#### PART 2 - PRODUCTS (not used)

#### PART 3 - EXECUTION

##### 3.01 PREPARATION

- A. Protect existing trees and other vegetation as directed by the Resident Engineer to remain in place, against unnecessary cutting, breaking or skinning of roots,

skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials.

B. Existing Trees, Brush, Shrubs, Gardens and Other Vegetation:

1. Protect trees by properly tying off, supporting, or pre-topping and trimming as required.
2. Protect shrubs and bushes by tying, staging, tarpaulins, net-work, fences or barricades.
3. Protect shallow-rooted plants at ground surface under and in some cases outside the spread of branches by covering, or by fences, or barricades to prevent vehicle access, or by bridging with timber mats to avoid overly compacting the root mass.

3.02 PERFORMANCE

A. Clearing:

1. Remove vegetation and topsoil in site compound, access roads, decontamination pad, and equipment pad areas.
2. Limits of clearing shall be as approved by the Resident Engineer.
3. Remove trees, fences, pipes, stumps, shrubs, grass, weeds and other vegetation, improvements, or obstructions that interfere with soil removal.
4. Remove such items elsewhere on the site or premises as specifically indicated.
5. Removal includes new and old stumps of trees and their roots.
6. All removed tree stumps shall be chipped and stockpiled in an area to be designated by the Resident Engineer.

3.03 RESTORATION

- A. Restore any items damaged by this work to their original condition, as acceptable to the Resident Engineer or other parties or authorities having jurisdiction.

- B. Repair or replace trees and vegetation damaged by construction operations, in a manner acceptable to the Resident Engineer.

END OF SECTION

## SECTION 02221

### EXCAVATION, TRENCHING, BACKFILL AND COMPACTION

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Special Project Procedures: Section 01125
- B. Existing Utilities and Underground Structures: Section 02016

##### 1.02 DESCRIPTION OF WORK

- A. Work Included:
  - 1. Earthwork for site preparation.
  - 2. Earthwork/trenching for Conveyance System.
  - 3. Backfilling of excavations.
  - 4. Surfacing of subgrade materials for structures and road improvements.
  - 5. The compaction of all backfill and subgrade materials.
  - 6. Disposal of material not suitable for backfill.
  - 7. Installation of access road, contractor parking and compound grading.

##### 1.03 JOB CONDITIONS

- A. Existing Utilities:
  - 1. Locate underground utilities in the areas of work.
  - 2. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
  - 3. If uncharted or incorrectly charted piping or other utilities are encountered during excavation, consult the Resident Engineer immediately for directions as to procedure.
  - 4. Cooperate with the Naval Subase in keeping respective services and facilities in operation.
  - 5. Repair damaged utilities to satisfaction of the Resident Engineer.
  - 6. Do not interrupt existing utilities serving facilities occupied and used by the Naval Subase.

B. Protection of Persons and Property:

1. Protect the public, structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Resident Engineer in writing of conditions detrimental to the proper and timely completion of the work.

3.02 EXCAVATION AND TRENCHING

A. Trenching:

1. Excavation of trenches for conveyance piping and electrical conduits shall be excavated as shown on Drawings.
2. Trenches are to be excavated along alignment indicated on drawing or as directed by Resident Engineer.

B. Unauthorized Excavation:

1. There is to be no removal of materials beyond indicated limits or dimensions without specific direction of the Resident Engineer. No payment shall be given for unauthorized excavations.

3.03 COMPACTION

A. Percentage of Maximum Dry Density Requirements:

1. Provide not less than the following percentages of maximum dry density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place.
  - a. Unpaved Areas: Compact top 4 inches of subgrade and each 6 inch layer of backfill or fill material at 90 percent maximum

density for cohesionless soils and 85 percent maximum density for cohesive soil material using a 6,000 lb. compaction roller.

### 3.04 BACKFILL

#### A. General:

1. Where backfill is required, the backfill will be free of large debris, including rocks and organic materials.

### 3.05 GRADING

#### A. General:

1. Uniformly grade areas within limits of grading under this section.
2. Smooth finish surface within specified tolerances, compact with uniform levels of slopes and existing grades.
3. Grade access road to slope away from center of road per drawings.

END OF SECTION

## SECTION 02613

### PRESSURE PIPE

#### PART 1 - GENERAL

1.01 RELATED DOCUMENTS: The general provisions of the Contract, including General Requirements apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. Excavation, Backfill, and Compaction: Section 02221
- B. Field Testing of Pressure Pipe: Section 02651
- C. Exterior water distribution system: Section 02661
- D. Piping and Valves: Section 15060

1.03 DESCRIPTION

- A. Work Included: Furnish and install the pipe materials and fittings of the types and sizes, and in the locations shown on the Drawings and as specified herein.
- B. The extent of the work is generally shown on the Drawings and shall be extended to accommodate changes which become necessary as a result of encountering unforeseen and changed conditions in the field.
- C. Above ground piping and valves and appurtenances are detailed in Section 15060.

1.04 SUBMITTALS

- A. Furnish the name of the manufacturer to the Contractor prior to commencing work. For any given material, use pipe of the same manufacturer throughout the project.
- B. The Contractor may request the Subcontractor to submit manufacturer's certification that the product meets requirements of the Specification.

1.05 QUALITY ASSURANCE: All materials shall conform to the standards designated in Part 2 for the appropriate material.

## PART 2 - PRODUCTS

### 2.01 GENERAL

#### A. Polyvinyl chloride (PVC) Pressure Pipe

1. Standards:
  - a) Pipe: ANSI/AWWA C900
  - b) Gaskets: ASTM F 477
2. Class: 200 (DR 14)
3. Use push-on joints with elastomeric gasket.
4. Outside diameter equivalent to ductile iron pipe.
5. Use mechanical joint fittings for changes in direction and provide restraint as detailed for ductile iron pipe.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. General:

1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations.
2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
3. Install adapters, as required, when connecting pipes constructed of different materials.

#### B. Pipe Laying

1. Firmly support the pipe and fittings on the bottom of trenches as shown on the Drawings and as specified in the appropriate Sections of these Specifications.
2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material that does not provide firm and uniform bearing along the outside length of the pipe.

3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
4. Excavate suitable holes for the joints so that only the barrel of the pipe receiving bearing pressure from the supporting material after placement.
5. Lay each pipe length so it forms a close joint with the adjoining length and bring the inverts to the required grade.
6. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer, or any other unyielding object.
7. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
8. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
9. Take all necessary precautions to prevent the floatation of the pipe in the trench.

C. Temporary Plugs

1. When pipe installation work in trenches is not in progress, close the open ends of the pipe with temporary watertight plugs.
2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.
3. Do not use the pipelines as conductors for trench drainage during construction.

D. Jointing

1. Connect pipe in accordance with the latest manufacturer's instructions and recommendations.
2. Clear each pipe length, coupling and fitting of all debris and dirt before installing.
3. Provide and use coupling pullers for jointing the pipe.

4. Provide gasket feeler gauges for use by the pipe layer for checking the position of the rubber gaskets in the completed joints.
5. Shove home each length of pipe against the pipe previously laid and hold securely in position. Do not pull or cramp joints.
6. Make all pipe joints as watertight as possible with no visible leakage and no sand, silt, clay, or soil of any description entering the pipeline at the joints.
7. Immediately after making a joint, fill the holes for the joints with bedding material, and compact.

E. Pipe Cutting

1. Cut in accordance with manufacturer's recommendations.
2. Cut the pipe with a hand saw, metal-inserted abrasive wheel, or pipe cutter with blades (not rollers).
3. Examine all cut ends for possible cracks caused by cutting.

END OF SECTION

## SECTION 02651

### FIELD TESTING OF PRESSURE PIPE

#### PART 1 - GENERAL

- 1.01 RELATED DOCUMENTS: The general provisions of the Contract, including General Requirements apply to the work specified in this Section.
- 1.02 RELATED WORK SPECIFIED ELSEWHERE
- A. Excavation, Backfill, and Compaction: Section 02221
  - B. Pressure Pipe: Section 02613
  - C. Exterior Water Distribution System: Section 02661
- 1.03 DESCRIPTION
- A. Work Included: Furnish all equipment and material and perform pressure tests as specified herein.
- 1.04 SUBMITTALS: Submit to the Contractor the proposed testing procedure for approval, at least 30 days prior to starting testing.

#### PART 2 - PRODUCTS (not used)

#### PART 3 - EXECUTION

- 3.01 PRESSURE TESTING: ACCESSORIES FOR TESTING: Subcontractor shall furnish and install the necessary water, pumps, pressure gauges, fittings, and accessories for attaching Subcontractor-furnished pressure gauges, pumps, etc. to be used in pressure tests. This equipment shall be connected to mains or plugs at points therein acceptable to the Contractor.
- 3.02 GENERAL REQUIREMENTS:
- A. Test procedures and method of disposal of water shall be approved by the Contractor. All tests shall be made in the presence of the Resident Engineer. Preliminary tests made by the Subcontractor without being observed by the Resident Engineer will not be accepted. Notify the Resident Engineer at least 24 hours before any work is to be inspected or tested.

- B. All defects in piping systems shall be repaired and/or replaced and retested until acceptable. Repairs shall be made to the standard of quality specified for the entire system.
- C. Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested. Pressure tests shall be made between valves to demonstrate ability of valves to sustain pressure.
- D. All piping shall be tested in accordance with the following test methods, in addition to any test required by local and state codes or building authorities.
- E. Prior to testing, flush all piping systems with water to remove construction debris.
- F. Should the pipe fail to meet the test requirements, re-excavate and repair at no cost to the Contractor.

3.03 **BACKFILL AND BLOCKING FOR PRESSURE PIPE:** After pressure pipe has been laid, it should be partially backfilled, except for joints. Where any section of the main is provided with concrete thrust blocking, the hydrostatic pressure test shall not be made until at least 5 days after the concrete is placed.

#### 3.04 **PRESSURE TEST FOR PRESSURE PIPE**

- A. All force mains, process piping, water mains and services, and any other piping subject to pressure testing shall pass the following hydrostatic pressure test.
- B. Tests for any exposed piping shall be made before covering and insulation is placed.
- C. The pressure test for buried piping shall be made after all jointing operations are completed and any concrete reaction blocks and restraints have cured at least five days. Lines tested before backfill is in place shall be retested after compacted backfill is placed.
- D. All service connections to water mains shall be completed prior to testing.
- E. Sections of piping between valves and other short sections of line may be isolated for testing. If shorter sections are tested, test plugs or bulkheads required at the end of the test section shall be furnished and installed by the Subcontractor, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure without imposing any thrust on the

pipeline. The Subcontractor shall be solely responsible for any damage which may result from the failure of test plugs or supports.

- F. Before joints are covered, each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation for the hydrostatic pressure test, all air shall be expelled from the pipe through blow-offs, air reliefs, or temporary taps. All piping shall be subjected to hydrostatic pressure of at least 50 psi, +/- 2 psi maximum variation, or two times the operating pressure, whichever is greater, for a period of at least 2 hours. Pressure shall be applied to the piping by means of a hand pump. For the duration of the test, the lines shall be thoroughly inspected for leakage at all joints and elimination of leakage effected where necessary. Any cracked or defective pipes, joints, fittings, or valves discovered in consequence of the pressure test shall be removed and replaced by the Subcontractor at his own expense. All defects shall be remedied to the satisfaction of the Contractor. Tests will be continued until all visible leaks have been eliminated from the part of the system under test.
- G. After replacing or correcting cracked or defective pipe, fittings, etc. discovered in the pressure test, the Subcontractor shall re-test the pipe at his own expense.

END OF SECTION

SECTION 02661

EXTERIOR WATER DISTRIBUTION SYSTEM  
(MINOR CONSTRUCTION)

1.1 REFERENCES

All local, state, and federal codes as applicable to the installation of potable water conveyance system. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ANSI/ASME B16.4            1985 Cast Iron Threaded Fittings Classes 125 and 250

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM B 62	1990 Composition Bronze or Ounce Metal Castings
ASTM D 1785	1991 Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2466	1990 (Rev. A) Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	1991 (Rev. A) Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe Systems
ASTM D 2774	1972 (R 1983) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	1990 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

ASTM F 402

1988 Safe Handling of Solvent Cements, Primers,  
and Cleaners Used for Joining Thermoplastic Pipe  
and Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C203

1986 Coal-Tar Protective Coatings and Linings  
for Steel Water Pipelines - Enamel and Tape -  
Hot Applied

AWWA C500

1986 Gate Valves for Water and Sewerage  
Systems

AWWA C600

1987 Installation of Ductile-Iron Water Mains and  
Their Appurtenances

AWWA C701

1988 Cold-Water Meters - Turbine Type, for  
Customer Service

AWWA C800

1989 Underground Service Line Valves and  
Fittings

AWWA M23

1980 PVC Pipe - Design and Installation

MANUFACTURERS STANDARDIZATION SOCIETY OF THE  
VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-80

1987 Bronze Gate, Globe, Angle and Check  
Valves

1.2 RELATED REQUIREMENTS

All work shall be performed by a licensed plumber in the state of Georgia.

1.3 DESIGN REQUIREMENTS

1.3.1 Water Service Lines

Provide water service line indicated as 1½-inch line from water distribution main to the points indicated on the drawings by the water meter. Water service lines shall be steel pipe. Provide water service line appurtenances as required.

Provide water service lines indicated as 1½-inch or ¾-inch lines from water meter to the points indicated on the drawings. Water service lines shall be polyvinyl chloride (PVC) plastic pipe. Provide water service line appurtenances as required.

#### 1.4 SUBMITTALS

##### 1.4.1 Manufacturer's Catalog Data

- a. Water service line piping, fittings, joints, valves and couplings
- b. Valve boxes
- c. Water meters
- d. Backflow preventer

Submit manufacturer's standard drawings or catalog cuts for the listed items, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings.

##### 1.4.2 Drawings and Related Information

- a. Installation procedures for water piping
- b. Layout drawings indicating all connections, valves, etc.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping and jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

##### 1.5.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store rubber gaskets and plastic piping and jointing materials that are not to be installed immediately, under cover out of direct sunlight.

## PART 2 PRODUCTS

### 2.1 WATER SERVICE LINE MATERIALS

#### 2.1.1 Piping Materials

##### 2.1.1.1 Plastic Piping

Plastic pipe and fittings shall bear the seal of approval of the National Sanitation Foundation for potable water service. Plastic pipe and fittings shall be supplied from the same source.

- a. Polyvinyl Chloride (PVC) Plastic Piping: ASTM D 1785, Schedule 40. Fittings shall conform to ASTM D 2466. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12; PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing shall conform to ASTM D 2564.

##### 2.1.1.2 Steel Pipe and Associated Fittings

Pipe shall conform to ASTM A 53, Standard Weight, zinc-coated. Fittings shall conform to ANSI/ASME B16.4, Class 125, zinc-coated.

##### 2.1.1.3 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

#### 2.1.2 Water Service Line Appurtenances

##### 2.1.2.1 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Where multiple gooseneck connections are required for an individual service, connect goosenecks to the service line through a brass or bronze branch connection; the total clear area of the branches shall be at least equal to the clear area of the service line. Length of goosenecks shall be in accordance with standard practice.

##### 2.1.2.2 Curb or Service Stops

Ground key, round way, inverted key type; shall be made of bronze conforming to ASTM B 62; and rated at 150 psi. Ends shall be as appropriate for connection to the

service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.

#### 2.1.2.3 Gate Valves Smaller Than 3-inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged end connections, or threaded end connections with a union on one side of the valve and a handwheel operator.

#### 2.1.2.4 Curb Boxes

Provide for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

#### 2.1.2.5 Valve Boxes

Provide for each gate valve on buried piping. Valve boxes shall be of [precast concrete] a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches.

### 2.2 WATER METERS

Meter shall register in U.S. gallons AWWA C701 (Residential service use).

## PART 3 EXECUTION

### 3.1 INSTALLATION OF PIPELINES

#### 3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to pipeline installation. Submit prior to execution of work diagram for pipe layout and connection showing all valves, meters, reducers, etc.

##### 3.1.1.1 Location of Water Lines

The work covered by this section shall terminate at a point indicated on the drawings. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sanitary sewer line. Lay water lines which cross sanitary sewer force mains and inverted siphons at least 2 feet above these sewer lines; when joints in the sanitary sewer line are closer than 3 feet horizontally from the water line, encase these joints in concrete. Do not lay water lines in the same trench with electric wiring.

- a. Sanitary Sewer Piping or Sanitary Sewer Manholes. No water piping shall pass through or come in contact with any part of a sewer manhole.

#### 3.1.1.2 Earthwork

#### 3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Grade pipeline in straight lines; avoid formation of dips and low points. Support pipe at proper elevation and grade, and secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevents installation. Waterline shall be 24 inch below grade.

#### 3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

#### 3.1.1.5 Connections to Existing Lines

After approval is obtained, make connections to existing water lines with a minimum interruption of service on the existing line. Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the branch. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Contractor in writing at least 5 days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials required to make connections into the existing water supply systems and perform all excavation, backfilling, and other incidental labor as required.

### 3.1.3 Installation of Water Service Piping

#### 3.1.3.1 Location

Connect water service piping to the water meter. Connect piping from water meter to service distribution points as indicated on drawings. Where service is future connection, provide stub-out closed with plugs or caps.

#### 3.1.3.2 Service Line Connections to Water Mains

Connect service lines 1½-inch size to the main as required by local codes.

#### 3.1.3.3 Special Requirements for Installation of Metallic Piping

- a. **Metallic Piping Installation, General:** Install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" and with applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.
- b. **Jointing:**
  - (1) **Threaded Joints:** Make threaded joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or an approved graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling joint.
- c. **Protection of Buried Steel Service Line Piping:** Unless otherwise specified, prepare, prime, and coat exterior surface of zinc-coated steel pipe and associated fittings to be buried with hot-applied coal-tar enamel with a bonded single layer of felt wrap in accordance with AWWA C203. For the felt wrap material, use fibrous-glass mat as specified in Appendix Sec. A2.1 of AWWA C203; use of asbestos felt will not be permitted. Use solvent wash only to remove oil, grease, and other extraneous matter from zinc coated pipe and fittings.

#### 3.1.3.4 Special Requirements for Installation of Plastic Piping

- a. **Plastic Piping Installation, General:** Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

- b. Jointing: Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
- c. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

#### 3.1.4 Installation Under Roadway

Pipe installed under the roadway will be sleeved with a cast iron sleeve with an inside diameter at least 2 times the outside diameter of the piping. Depth of sleeve shall be 48 inches below road surface or 36 inches below lowest ditch line. Install with a road boring.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Field Tests and Inspections

The Contractor will conduct field inspections and witness field tests specified in this section. The Subcontractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Subcontractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

#### 3.2.2 Testing Procedure

Test water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints.

#### 3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

END OF SECTION



## PART 2 PRODUCTS

### 2.1 CHAIN-LINK FENCING AND ACCESSORIES

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

#### 2.1.1 Fabric

FS RR-F-191/1; Type IV, polyvinyl chloride (PVC) coated over zinc-coated steel, 9-gauge core wire size. Mesh size, 2 inches. Provide selvage knuckled at one selvage and twisted and barbed at the other. Height of fabric should be 8.0 ft.

#### 2.1.2 Gates

FS RR-F-191/2; Type II, double swing. Shape and size of gate frame, as indicated on drawings. Framing and bracing members, should be round of steel alloy PVC-coated over zinc. Gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade except that steel pipe frames shall be 1.90 inches O.D., 0.12 inches minimum wall thickness and aluminum pipe frames and intermediate braces shall be 1.86 inches O.D., 0.940 lb/ft of length. Gate fabric, as specified for fencing fabric. Barbed wire top on gate, as specified herein. Coating for steel latches, stops, hinges, keepers, and accessories, PVC, minimum thickness of 0.010 inch. Gate latches, plunger bar type. Gate leaves more than 8 feet wide shall have intermediate members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

#### 2.1.3 Posts, Top Rails, Bottom Rails and Braces

FS RR-F-191/3 line posts; Class 1, steel pipe, Grade A. End, corner, and pull posts; Class 1, steel pipe, Grade A. Braces; Class 1, steel pipe, Grade A in minimum sizes listed in FS RR-F-191/3 for each class and grade. Provide PVC color coating, minimum thickness, 0.10 inch.

#### 2.1.4 Fencing Accessories

FS RR-F-191/4. Provide accessories with polyvinyl (PVC) coatings similar to that specified for chain-link fabric or framework.

### 2.1.5 Concrete

ASTM C 94, using 3/4-inch maximum-size aggregate, and having minimum compressive strength of 3000 psi at 28 days.

### 2.1.6 Padlocks

ASTM F 883, with chain.

## PART 3 EXECUTION

Prior to execution submit product information regarding materials to be submitted.

### 3.1 SITE PREPARATION

#### 3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

#### 3.1.2 Excavation

Excavate to dimensions indicated for concrete-embedded items, except in bedrock. If bedrock is encountered, continue excavation to depth indicated or 18 inches into bedrock, whichever is less, with a diameter in bedrock a minimum of 2 inches larger than outside diameter of post. Clear post holes of loose material. Dispose of waste material on station, as directed.

### 3.2 FENCE INSTALLATION

Install fence on prepared surfaces to line and grade indicated. Secure fastening and hinge hardware in place to fence framework by peening or welding. Allow for proper operation of components. Coat peened or welded areas with a repair coating matching original coating.

#### 3.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10-feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade.

### 3.2.2 Post Setting

Set posts plumb. Allow concrete to cure a minimum of 72 hours before performing other work on posts.

#### 3.2.2.1 Earth and Bedrock

Provide concrete bases of dimensions indicated in statement of work. Compact concrete to eliminate voids, and finish to a dome shape.

### 3.2.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and a diagonal truss rod and truss tightener used as a tension member.

### 3.2.4 Top and Bottom Tension Wires

Install bottom tension wires before installing chain-link fabric, and pull wires taut. Place bottom tension wires within 8 inches of respective fabric line.

### 3.2.5 Fabric

Pull fabric taut and secure fabric to top rail and bottom rail and bottom wire, close to both sides of each post and at maximum intervals of 24 inches on center. Secure fabric to posts using stretcher bars, ties or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post. Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is 2 inches above ground level. Install fence fabric to provide approximately 2-inch deflection at center of fabric span between two posts, when a force of approximately 30 pounds is applied perpendicular to fabric. Fabric should return to its original position when force is removed.

## 3.3 ACCESSORIES INSTALLATION

### 3.3.1 Post Caps

Install post caps as recommended by the manufacturer.

### 3.3.2 Supporting Arms

Design supporting arms to accommodate top rail. Install supporting arms as recommended by manufacturer. In addition to manufacturer's standard connections, permanently secure supporting arms to posts. Studs driven by low-velocity powder-actuated tools may be used with steel, wrought iron, ductile iron, or malleable

iron. Do not use studs driven by powder-actuated tools with gray iron or other material that will fracture.

### 3.3.3 Barbed Wire

Install barbed wire on supporting arms above fence posts. Extend each end member of gate frames sufficiently above top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Pull each strand taut and securely fasten each strand to each supporting arm or extended member. Secure wires in accordance with fence manufacturer's recommendations.

### 3.3.4 Gates

Install swing gates to swing through 180 degrees from closed to open.

### 3.3.5 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

## 3.4 GROUNDING

Ground fencing at two opposite corners.

## 3.5 CLEANUP

Remove waste fencing materials and other debris from the station.

END OF SECTION

*DIVISION 3*

*CONCRETE*

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Excavation, backfill, and compaction: Section 02221

##### 1.02 DESCRIPTION OF WORK

- A. Work to include concrete work indicated on drawings

##### 1.03 QUALITY ASSURANCE

- A. Each load of concrete will be sump tested in accordance with ASTM C143 at the Subcontractors expense. This testing can be performed by a qualified representative of the Subcontractors staff. Slump shall be within 1 inch of specified range.
- B. No more than 10 gallons of water may be added at the site to any 10 cubic yard load of concrete to achieve specified slump.
- C. All concrete trucks shall rotate concrete drum 30 times at mixing speed, at the site, prior to discharge of concrete.
- D. Fly ash is not allowed.

##### 1.04 JOB CONDITIONS

- A. Access to the site by the Subcontractor's suppliers shall be coordinated through the Contractor at least 24 hours in advance, Supplier requirements to be given by the Subcontractor will include name, social security number, and place of birth. The driver shall have in his possession at time of arrival at security checkpoint, a photo I.D. and proof of insurance for the vehicle. Allow for 30 minutes to clear for Base access.

##### 1.05 REFERENCES

- A. ACI Standards
  - 1. 301 - Specifications for Structural Concrete for Buildings
  - 2. 315 - ACI Detailing Manual

3. 318 - Building Code Requirements for Reinforced Concrete
- B. ASTM Standards
1. C33 - Concrete Aggregated
  2. C94 - Ready-Mixed Concrete
  3. C150 - Portland Cement
  4. C494 - Chemical Admixtures for Concrete

## PART 2 - PRODUCTS

### 2.01 CONCRETE

- A. Portland Cement: ASTM C150, Type I or II
- B. Fine Aggregate: ASTM C33
- C. Coarse Aggregate: ASTM C33

### 2.02 MATERIALS OTHER THAN CONCRETE

- A. Admixtures, where required, shall conform to the following:
  1. Air-Entraining Admixture: ASTM C260
  2. Water-Reducing Admixture: ASTM C494 Type A
  3. Set-Retarding Admixture: ASTM C494 Type B
- B. Reinforcing
  1. Reinforcing bars shall be new deformed billet steel bars conforming to ASTM A615 Grade 40 or Grade 60.
  2. Reinforcing mesh shall be welded wire fabric conforming to ASTM A185, mesh and gauge as designated on the Drawings
- C. Reinforcing Accessories

Reinforcement accessories shall be free from rust, scale, grease, clay, and other coatings or foreign substances which would reduce the bonding qualities. Materials shall be as follows:

1. The wire shall be annealed wire, not less than No. 16 gauge, of suitable quality for securing reinforcement in place.

2. Bar supports shall be standard bright basic wire sufficiently heavy to properly carry the steel they support. Wire pieces and number of supports shall conform to specifications for placing accessories as published by the Concrete Reinforcing Steel Institute.

D. Water stops shall be extruded polyvinyl-chloride

E. Water: ASTM C94, Section 4.

### 2.03 CONCRETE QUALITY

A. Concrete shall be batched, mixed and delivered in accordance with ASTM C94, "Ready-Mixed Concrete" as further defined below, and within this Specification:

1. Aggregate shall conform to ASTM C33. Coarse aggregate shall be No. 67 ( $\frac{3}{4}$ -inch to No. 4 sieve).

2. Cement shall be an approved brand of Portland cement conforming to ASTM C150 Type I or II. A single brand of cement shall be used throughout the work.

3. Clean potable water shall be used throughout the work.

B. All concrete shall have a minimum allowable compressive strength of 4000 psi minimum at 28 days.

C. Concrete which will remain exposed to the weather in the finished work shall contain an air entraining admixture which produces the following air content at the point of discharge from the transport vehicle:

Maximum Aggregate  
Size (Inches)  
 $\frac{3}{4}$

Total Air Cement  
(Percentage by Volume)  
2 to 3

D. Admixtures may be used in concrete. Usage shall be in accordance with the recommendations of the manufacturer of the admixture.

E. Concrete slump shall be 4 inches.

## PART 3 - EXECUTION

### 3.01 MIXING AND DELIVERY

#### A. Cold Weather Concreting

1. Concrete mixed and delivered when the mean ambient temperature 40°F or less shall be mixed and delivered in accordance with the American Concrete Institute Standard ACI 306 "Recommended Practice for Cold Weather Concreting."

#### B. Hot Weather Concreting

1. Concrete mixed and delivered when the mean ambient temperature (as defined in ACI 301, Section 8.4.3) would be detrimental to concrete, shall be mixed and delivered in accordance with the American Concrete Institute Standard ACI 305 "Recommended Practice for Hot-Weather Concreting." Concrete temperatures at time of discharge from the truck shall not exceed 90°F. During hot weather, the Subcontractor shall require the supplier of concrete to cool aggregates or incorporate shaved ice as part of the mixing water as necessary to meet this temperature requirement.

#### C. Delivery Trucks

1. Each load of concrete shall be accompanied by a delivery ticket, in triplicate. After the concrete has been discharged or the truck has been released, the Subcontractor will sign the delivery ticket as proof of receipt and acceptance or rejection. One (1) copy shall be retained by the Subcontractor for his records, and one (1) copy of each waybill shall be grouped with other waybills for the pour, and shall be delivered to the Contractor within 24-hours.

#### D. Allowable Time Interval Between Mixing and Placing

1. Concrete shall be placed within sixty (60) minutes or 300 revolutions of the drum after the addition of water to the cement and aggregate when hot weather conditions prevailed. At other times, the time limit shall be ninety (90) minutes or 300 revolutions of the drum. Discharge of the concrete shall be completed within the time limits specified above.

### 3.02 SAMPLING, TESTING, AND CONTROL

#### A. Slump Testing

1. Slump testing of delivered concrete will be in accordance with ASTM C143, performed by Subcontractor.

### 3.03 FORMWORK

#### A. Responsibility

1. The Subcontractor shall be responsible for design, adequacy, and safety of formwork. Formwork design shall conform to ACI 347, "Recommended Practice for Concrete Formwork."

#### B. Inspection

1. Inspection of formwork, reinforcing and embedded items shall have been completed and approval given before the forms are closed or concrete ordered for placement therein. The Subcontractor shall, in each case, allow the Contractor a minimum of four (4) working hours notice prior to anticipated start of pour to permit sufficient time for such inspection.

#### C. Removal of Forms

1. The minimum waiting period before stripping forms shall be in conformance with Table 5.1.7 of ACI 306. The use of this table shall not relieve the Subcontractor of responsibility for the safety of or damage to the work.

### 3.04 REINFORCING STEEL

#### A. General

1. Reinforcing steel shall be furnished, detailed and fabricated by the Subcontractor.
2. Reinforcing steel delivered to the site shall be stored off the ground. Before placement, reinforcing steel shall be thoroughly cleaned of loose or flaky rust, mill scale, or coatings or any foreign substance that would reduce or destroy the bond. Reinforcing steel reduced in section shall not be used. In the event of a substantial work delay, previously placed reinforcing steel shall be inspected and cleaned. Reinforcing steel shall not be bent or straightened in a manner injurious to the steel.

3. Heating to bend or straightened reinforcing steel shall not be permitted. Field splices shall be made with a wire-tied lap as required by ACI 318.
4. The clear distance between parallel bars shall be not less than the nominal diameter of the bars,  $1\frac{1}{3}$  times the maximum size of the coarse aggregate, or 1-inch, whichever is greater.

B. Concrete Covering Over Steel Reinforcement

1. The thickness of the concrete covering over steel reinforcement shall be at least 3 inches where concrete shall be in contact with the ground and 2 inches otherwise.

C. Supports

1. Reinforcing shall be placed and tied at all intersections and splices with black annealed wire. Reinforcement shall be held in position during the placing of concrete by spacers, chairs, or other approved supports. Wire tie-ends shall point away from the form. Unless otherwise indicated, the number, type and spacing of supports shall conform to ACI Standard 315.

3.05 PREPARATION FOR PLACING CONCRETE

- A. Water shall be removed from excavations before concrete is deposited. Hardened concrete, debris, and foreign materials shall be removed from the interior of forms, and from inner surfaces of conveying equipment.
- B. Reinforcement shall be secured in position, inspected and approved before depositing concrete. Runways shall be provided for wheeled concrete-handling equipment. In addition, the equipment shall not be wheeled over reinforcement, nor shall runways be supported on reinforcement.
- C. The subgrade for slab pours shall be finished to the exact section of the bottom of the slab pour, and shall be maintained in a smooth, compacted condition until the concrete is placed. Where concrete is placed directly on earth, the subgrade shall be clean and thoroughly moistened, but not muddy, at the time the concrete is deposited. Under adverse conditions it may be necessary for the Subcontractor to place a mud slab to meet the above criteria.
- D. Placement of concrete shall not be started until reinforcement and items set into the forms have been inspected and approved by the Contractor.

E. Joints

1. Construction Joints

Work shall be planned to require a minimum of field located construction joints. The type, number and locations of construction joints shall be submitted to the Contractor for approval. Shear keys shall be provided as required. Reinforcement shall be continuous through construction joints.

2. The Subcontractor shall be responsible for ensuring that slabs and other large flat areas of concrete shall be constructed in sections to minimize and control shrinkage cracks. Control joints shown on the Drawings may be wither tooled or saw cut to the depth shown on the Drawings, provided the saw cut is made within 24-hours after the concrete is placed, and also provided that the concrete to be saw-off will not be subjected to temperatures greater than 80°F during the first 24-hours.

F. Waterstops

1. Waterstops shall be installed in joints to provide a continuous diaphragm and shall be protected from damage and displacement during placing of concrete. Splices shall be made in accordance with the manufacturer's recommendations.

3.06 PLACING METHODS

Concrete shall be conveyed and placed as rapidly as practicable, wither by manual or mechanical means that will prevent segregation or loss of ingredients. Aluminum material shall not be used to convey or place concrete. Concrete shall be deposited continuously in horizontal layers so as to prevent displacing reinforcement.

3.07 CONCRETE FINISHERS

- A. Slab-on-Grade concrete surfaces shall be given brush flush.

3.08 CURING

- A. The Subcontractor shall be responsible for ensuring that concrete shall be started as soon after placing and finishing as the surface conditions are suitable. Curing of formed surfaces shall be accomplished by moist curing with forms in place for

the full curing period or, if forms are removed prior to the end of the curing period, by any of the following methods, or combinations thereof:

1. Wet Curing
2. Membrane Curing

END OF SECTION

*DIVISION 11*  
*EQUIPMENT*

## SECTION 11001

### EQUIPMENT - GENERAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. These General Provisions shall apply to all items of mechanical equipment, including those specified under DIVISION 15 - MECHANICAL. In case of conflict with other sections of DIVISION 15 -MECHANICAL, these provisions shall apply.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Mechanical: Division 15
- B. Electrical: Division 16

##### 1.03 DESCRIPTION

- A. Every item of equipment shall be the product of a domestic manufacturer experienced in the design, construction, and operation of equipment for the purpose required, and who shall have furnished such equipment with a record of successful operation.
- B. All parts and components of mechanical equipment shall be designed for satisfactory service under continuous duty with minimal, under the specified operating conditions, for a period of not less than one year.
- C. Any part of mechanical equipment that shows undue or excessive wear, or that fails due to normal operating conditions during the operation of the pretreatment facility shall be replaced with equipment or parts to meet the specified requirements.
- D. All parts of mechanical equipment shall be amply proportioned for all stresses which may occur during operations, and for any additional stresses which may occur during fabrication and erection.
- E. Iron castings shall be tough, close-grained gray iron casting in accordance with ASTM A 48-90. Structural steel shall conform to ASTM A 36-89.
- F. Mechanical Equipment, Including Drives and Electrical Motors Unless Otherwise Noted:

1. Supply and install in accordance with the Williams-Steiger Occupational Safety and Health Act of 1970 and subsequent amendments.
2. The Subcontractor's attention is drawn to the requirements for equipment guards.
3. The noise level of equipment, drives and motors, unless otherwise noted, shall not exceed 90 dBA measured 3 feet from the unit under field conditions.

1.04      **QUALITY CONTROL**

A.      **Standards**

1. The following organizations have published standards, codes or specification which are referenced in this Specification.

AMCA	Air Moving and Conditioning Association, Inc.
ASTM	American Society for Testing Materials
ASME	American Society of Mechanical Engineers
ANSI	American National Standards Institute
AGMA	American Gear Manufacturers Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
AWS	American Welding Society
AWWA	American Water Works Association
Federal	Federal Government Specifications
IEEE	Institute of Electrical and Electronic Engineers
NBFU	National Board of Fire Underwriters
NEMA	National Electrical Manufacturers Association
NEC	National Electrical Code

B.      **General Design of Equipment or Machinery**

1. Furnish latest improved design suitable for the service specified.
2. Designed and constructed to operate efficiently, continuously and quietly under the specified requirements with a minimum of maintenance, renewals and repairs.
3. Designed and constructed for outdoor use.
4. Such as to permit operation with minimum wear, vibration and noise when properly installed.

5. Allowable Amplitude Permitted: 2.0 mils maximum for blowers or any 3600 rpm machinery.
6. All Other Machinery: Maximum allowable amplitude of 4.0 mils.
7. Provide ample room for erecting, repairing, inspecting and adjusting of all equipment and machinery.
8. Design, Construction and Installation: Conform to and comply with the latest safety codes and regulations.
9. All Equipment of Identical Size, Type and Service: Product of the same manufacturer.
10. All equipment selected shall suit the general arrangement of the space in which it is to be installed.
11. Drive Units, Unless Otherwise Specified: Furnish with driven equipment, mounted and factory aligned; wiring of motors and controls by the electrical contractor.
12. All electrical equipment located in a hazardous location (Class 1, Division 1 and 2, Group D) shall comply with Articles 500 and 501 of the National Electrical Code.
13. Special Tools
  - a. Includes any type of tool that has been specially made for use on an item of equipment for assembly, disassembly, repair or maintenance.
  - b. Furnish those required to assemble, disassemble, repair or maintain any mechanical equipment with the equipment.
14. Electrical Work: Unless otherwise specified in the mechanical equipment, all electrical work, materials, and equipment shall conform to the provisions of DIVISION 16 - ELECTRICAL.
15. Nameplates for Equipment
  - a. Provide two nameplates for all equipment.

- b. Factory Nameplates: Riveted brass with stamped characters including rated capacity and head, speed, brake horsepower, model, size and serial number.
- c. Project Nameplates: Constructed of the same material to provide uniformity throughout the job.
- d. Attach nameplates to the machinery casing and to the panel where required for panel boards.
- e. Black-laminated phenolic plastic having engraved white letters and beveled white trim.
- f. Engrave with minimum 1/4 inch letters showing the equipment name and number as given on the Contract Drawings.
- g. Screw into the equipment frames.
- h. Spare Parts
  - 1. The Subcontractor is responsible for maintaining on site for eight months an adequate supply of spare parts so that the project schedule will not be impacted by normal equipment part failure.
  - 2. Tag with equipment name and number, suppliers name, and part number.
  - 3. Organize by equipment name and number and store where designated by the Contractor.
  - 4. Store as recommended by the manufacturers with regards to coating and corrosion and damage protection.
  - 5. Maintain on site an adequate supply of equipment lubricant and filters as per manufacturer's recommendations.

1.05 SUBMITTALS

- A. 3 copies of Catalog data, manufacturers specifications, performance data, and Shop Drawings, shall be submitted as specified in each section of this division.

PART 2 PRODUCTS

2.01 MATERIALS

A. Anchor Bolts and Bolts

1. Either stainless steel or cadmium-plated.
2. The Subcontractor shall furnish all anchor bolts for all equipment; and shall be in accordance with manufacturer's specifications as to quality, number and location.

B. Gear Reduction Units

1. Gears of Gear Reduction Units: Made of highest quality alloys treated for hardness and severe service.
2. All Gear Reduction Units on Equipment: Selected for Class II or more severe service as classified by the American Gear Manufacturers Association.
3. The Complete Reduction Unit: Fully enclosed in a heavy cast-iron housing with gears running in oil.
4. Bearings: Anti-friction type.
5. Actual and Rated Horsepower, Torque, Overhang Capacity, or Bearing Capacity: Not less than the horsepower rating of the drive motor nor less than that which will be encountered under full load or under the most severe loading conditions of the equipment, and the Engineer may reject any gear reduction unit that does not meet the above requirements.
6. Manufacturer: Long established with a good reputation.
7. Unless otherwise specified, helical or herringbone type.
8. Planetary gear units and worm gear type units may be used only where specified.
9. Furnish the Contractor with complete engineering information, catalog data, design features, loading capacities, and mechanical efficiency ratings.

C. Lubrication Fittings

1. Bring fittings to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards, or without creating falling hazards by unusual elevations.
2. Buttonhead type.
3. Mount together wherever possible.
4. Pressure Grease-lubricated Fittings: "Zerk Hydraulic" type or "Alemite" type.
5. Housings of Grease-lubricated Bearings: Automatically exhausted to the atmosphere to prevent excessive greasing.

D. Vents and Drains

1. Provide centrifugal type pumps with tapped vent and drain openings at the high and low points of the pump casing.
2. Fit vent and drain openings with brass petcocks.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Install equipment complete and ready to operate.
2. Maintain and lubricate all equipment until completion of the pretreatment operation.
3. Welding: By electric arc and best qualified welders in accordance with applicable welding codes of American Welding Society.
4. Metalwork to be Embedded in Concrete:
  - a. Accurately place and hold in correct position while the concrete is being placed.

- b. Clean surface of all metalwork to be in contact with concrete immediately before concrete is placed.
- c. Coat aluminum placed in concrete with bitumastic or coal tar epoxy to prevent corrosion.

5. Anchor Bolts for Aerators and Pumps

- a. Encase in metal tubing having an inside diameter of not less than two times that of the bolt, and fill the annular space with non-shrink, non-metallic grout after installation of the equipment.
- b. No concrete shall be placed for any item of equipment until anchor bolt locations and top elevation have been determined and bolts have been placed.

6. Mechanical Surface Aerators, Pumps and Other Similar Foundations for Rotating Equipment

- a. Leave one inch below the grade of the machine base, unless otherwise noted on the plans.
- b. After the proper setting of the machine for alignment and grade, grout the recess below the base, together with the space between the anchor bolt and the metal tube, and carefully finish.

7. Concrete Bases for Mechanical Equipment

- a. Concrete Base Thickness: Determined from elevations given on the Drawings and dimensions of approved Shop Drawings.
- b. Pads: Construct of such dimensions as to place the equipment at the elevations shown.
- c. Anchor Bolts: Show on the Shop Drawings.
- d. Provide sufficient embedment for all anchor bolts.

B. Alignment of Motors and Equipment

- 1. In every case where a drive motor is connected to a driven piece of equipment by flexible coupling, the coupling halves shall be

disconnected and the alignment between the motor and the equipment checked and corrected after the complete unit has been leveled on its foundation, and again after grout has set and foundation bolts have been tightened.

2. In general, checking and correcting the alignment shall follow the procedures set up in Section B (IX) of the Standards of the Hydraulic Institute, "Instructions for Installation, Operation, and Maintenance," for centrifugal pumps.
3. Equipment shall be properly leveled and brought into angular and parallel alignment.
4. Do not grout equipment bases or tighten foundation bolts until all piping connections are complete and at satisfactory alignment with no strain transmitted to the equipment.

### 3.02 FIELD QUALITY CONTROL

#### A. Testing

1. Moving Parts of Equipment and Machinery: Carefully install, test for operation, and adjust so that all parts move freely and function properly to insure satisfactory operation.
2. Replace defective parts without extra compensation.
3. Fill equipment with oil and grease, and furnish all power, water, personnel, chemicals, fuels, and accessories necessary for testing of the equipment for proper operation, efficiency, and capacity.

#### B. Service of Manufacturer's Representative

1. The Subcontractor shall include in his Contract price provisions for the services of Manufacturer's Representative for supervision of installation, and supervision of initial operation and operator instruction for pretreatment facility equipment.

2. When the equipment is placed in permanent operation by the Subcontractor, such representative shall be on hand to make all adjustments and tests necessary or required by the Contractor to prove that such equipment is in proper and satisfactory operating condition.

END OF SECTION

SECTION 11313

CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

1.02 DESCRIPTION

- A. Furnish and install horizontal end suction centrifugal pump(s) with all necessary circuitry and appurtenances, of type(s), capacity(ies), and at location(s) indicated on the Drawings and as specified herein.
- B. All equipment shall be designed for outdoor service.

1.03 QUALITY ASSURANCE

- A. Acceptable Manufacturers
  - 1. Worthington P1000-201-654-3300
  - 2. or approved equal.

1.04 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Performance Data.
- D. Shop Drawings.
- E. Operation and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. **Pump Construction:** Except as specified below, horizontal centrifugal pumps shall be constructed in accordance with the Hydraulic Institute (HI) publication, Standards for Centrifugal, Rotary and Reciprocating Pumps.
1. **Casing**
    - a. All ductile iron construction and designed to permit rear impeller pullout.
    - b. **Suction and Discharge Nozzle:** Fit with a suitably sized ANSI Class 150 lb. flange connection.
    - c. Centerline construction.
    - d. Equip with casing wearing rings suitable for intended service in front and rear of impeller.
    - e. Provide with tapped and plugged holes for priming, vent, drain and gage connections.
    - f. Direction of shaft rotation shall be conspicuously indicated.
  2. **Impeller**
    - a. Enclosed or semi-open type and all cast iron construction.
    - b. Statically and dynamically balanced.
    - c. Key and lock to the shaft by an impeller flange.
    - d. Easily removable from the shaft without the use of special tools.
  3. **Shaft and Shaft Sleeve**
    - a. Construct of high strength carbon steel suitably turned, ground, and polished.
    - b. Size to provide a minimum amount of deflection.
    - c. Protect from wear in the mechanical seal area by a renewable hardened 400 series stainless steel shaft sleeve.
    - d. Securely lock sleeve in place to prevent axial movement.

4. Stuffing Box
  - a. Provide with a single inside unbalanced mechanical shaft seal for leakless operation.
  - b. Provide with connection to lubricate and cool the seal faces with pumped liquid.
  - c. Provide seal with material intended for services.
5. Bearing Frame: Cast iron construction designed to provide a self-centering and self-indexing fit with the wetted end of the pump to insure proper alignment of the bearings and stuffing box.
6. Bearings
  - a. Ball type on both ends of the frame.
  - b. Locked in place.
  - c. Sized to provide a minimum B-10 life of [24,000] hours under all loads encountered.
  - d. Enclosed by replaceable caps and grease lubricated with provisions for the addition and relief of grease.
7. Baseplate and Coupling
  - a. Mount pump and motor on a fabricated steel or cast iron baseplate designed for all loads encountered.
  - b. Include a tapped hole to pipe away leakage and condensation.
  - c. The pump shall be flexible coupled to the motor specified herein and include a guard fastened to the baseplate which conforms to the requirements of ANSI B15.1, and meeting OSHA requirements.

B. Pump Drive

1. Furnish with a horizontal squirrel cage induction type motor suitable for the electrical service shown on the drawings.
2. The motor design and quality shall meet the requirements of Section 16150 of these Specifications.

3. Each motor shall be for totally enclosed-fan cooled continuous duty.
4. Motors shall have a 1.15 service factor.
5. The pump curve shall be such that, throughout the entire pump operating range, the brake horsepower required shall not exceed the motor rating.
6. Motors shall have normal-starting-torque and low-starting current characteristics.

C. Accessories

1. Couplings and Supports: Provide flexible drive coupling, guards, motor supports, and pump bases.
2. Water Seal Connection: Provide as necessary.
3. Gauges
  - a. Suction: Compound gauge reading 20 feet of water above and below atmospheric.
  - b. Discharge: Pressure gauge reading 0 to 50 feet of water above atmospheric.
  - c. 4- $\frac{1}{4}$ " diameter, black with phosphor bronze bourdon tubes and cast iron bottom neoprene diaphragm seal attachment.
  - d. Movements: Stainless steel rack and pinion type.
  - e. U.S. Gauge Co., Crosby Gauge Co., or Helicoid.
  - f. Install with a short nipple and 1-inch shut-off valve, furnished complete with factory mounted protective diaphragm seal attachment.
  - g. Diaphragm Seal: Allows cleaning of the lower diaphragm assembly without breaking the seal or refilling.
  - h. Diaphragms: Removable with all wetted surfaces 316 stainless steel.
  - i. Diaphragm Seals: Manufactured by H.O. Trerice, Ametek, or approved equal.

#### 4. Equipment Guards

- a. Equipment shall be provided with all-metal guards enclosing the drive mechanism.
- b. Guards shall conform in all respects to all applicable safety codes and regulations.
- c. Guards shall be secured in position by steel braces or straps which will permit easy removal for servicing the equipment.

2.02 PUMP SCHEDULE: Design Basis attached at end of section.

### PART 3 EXECUTION

#### 3.01 FACTORY TESTING

- A. Test each pump and motor assembly as a unit on water at the manufacturer's plant before shipment.
- B. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency, and brake horsepower and at such other conditions of head and capacity to properly establish the performance curve.
- C. Submit certified copies of the test curves to the Contractor.
- D. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

#### 3.02 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations, and make all adjustments required to provide complete and satisfactory operation upon completion of the Contract.
- B. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout.
- C. No extra compensation will be allowed for differences between actual dimensions and those shown on the Contract Drawings.

### 3.03 FIELD QUALITY CONTROL

- A. After installation of the pumping unit and appurtenances is complete, operating tests shall be carried out in the presence of the Contractor for a minimum of two hours.
- B. Each pumping unit shall be operated at its rated capacity.
- C. The Subcontractor shall provide an accurate and acceptable method for measuring discharge flow.
- D. Tests shall assure that the units and appurtenances have been installed correctly, and that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.
- E. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconstructed.

3.04 SERVICE: When the equipment is capable of being operated, the equipment manufacturer shall furnish competent personnel for a period not to exceed two (2) days to check the completed installation and instruct the Contractor's personnel in its use.

PUMP SCHEDULE

<u>Description</u>	<u>Pump Number</u>	<u>Pump Capacity (GPM)</u>	<u>Maximum Speed (RPM)</u>	<u>TDH (Feet)</u>	<u>Minimum Pump Efficiency</u>
Transfer Pump	P-02	60	1750	50	70
Effluent Pump	P-03	60	1750	10	70
Air Sparger and/or Air Stripper Feed Pump	P-06	60	1750	38	70

END OF SECTION

## SECTION 11315

### EXTRACTION WELL PUMPS

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

##### 1.02 DESCRIPTION

- A. Furnish and install extraction well pumps and all circuitry, control panels and accessories at the locations indicated on the Drawings and as specified herein. Optional pumps may be selected by the Contractor based on aquifer performance characteristics.
- B. All equipment shall be designed for outdoor service.

##### 1.03 QUALITY CONTROL

- A. Acceptable Manufacturers
  - 1. Grundfos - 209-292-8000.
  - 2. Approved equal.

##### 1.04 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Performance Data.
- D. Shop Drawings.
- E. Operation and Maintenance Manuals.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Pump Construction

The following components shall all be 304 stainless steel.

1. Check valve and housing.
2. Diffuser chamber.
3. Impeller.
4. Inlet Screen.
5. Straps.
6. Cable guards.

#### B. Motors

#### C. Electrical Enclosures shall be NEMA 3R.

1. See schedule.
2. The motor design and quality shall meet the requirements of Section 16150 of these specifications.
3. Motors shall have a 1.15 service factor.
4. The pump curve shall be such that throughout the entire pump operating range, the brake horsepower required shall not exceed the motor rating.
5. Motors shall have normal-starting torque and low-starting current characteristics.
6. Designed for NEMA 3R service.
7. Motors 1/2 hp and above shall operate on 480V, 3-phase service. Motors below 1/2 hp shall operate on 120V/240V, single phase.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations, and make all adjustments required to provide complete and satisfactory operation.

- B. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout.
- C. No extra compensation will be allowed for differences between actual dimensions and those shown on the Contract Drawings.

3.02 FIELD QUALITY CONTROL

- A. After installation of the pumping unit and appurtenances is complete, operating tests shall be carried out in the presence of the Contractor for a minimum of two hours.
- B. Each pumping unit shall be operated at its rated capacity.
- C. The Subcontractor shall provide an accurate and acceptable method for measuring discharge flow.
- D. Tests shall assure that the units and appurtenances have been installed correctly, and that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.
- E. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

3.03 SERVICE: When the equipment is capable of being operated, the equipment manufacturer shall furnish competent personnel for a period not to exceed two (2) days to check the completed installation and instruct the Contractor's personnel in its use.

END OF SECTION

**EXTRACTION WELL PUMP  
SCHEDULE**

<b>PUMP</b>	<b>NUMBER</b>	<b><u>PUMP SPEED</u></b> (rpm)	<b>TDH</b> (feet)	<b><u>MAXIMUM</u></b> (hp)
Submersible	6	3450	62 at 13.5 gpm	1/3 @ 3450
Submersible Option A	6	3450	62@ 20 gpm	1/2 @ 3450
Submersible Option B	6	<u>3450</u>	62 @ 7 gpm	1/3 @ 3450

END OF SECTION

## SECTION 11319

### SUMP PUMPS

#### PART 1 GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

##### 1.02 DESCRIPTION

- A. Furnish and install a sump pump of type, capacity, and at the location indicated on the attached Schedule and as specified herein.
- B. Furnish and install all necessary circuitry, control panels, alarms, level sensors and other appurtenances as shown on the Drawings and as specified in this Section.
- C. All equipment shall be designed for outdoor service.

##### 1.03 QUALITY CONTROL

- A. Acceptable Manufacturers:
  - 1. Goulds - 315-568-2811
  - 2. Big Johns.
  - 3. or approved equal.

##### 1.04 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Performance Data.
- D. Shop Drawings.
- E. Operation and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Pump Construction: Except as specified below, submersible centrifugal sump pumps shall be constructed in accordance with the Hydraulic Institutes (HI) publication, Standards for Centrifugal, Rotary and Reciprocating Pumps.

1. Casing

- a. High strength, cast iron with a stainless steel shaft.
- b. All fasteners in stainless steel.

2. Impeller

- a. Semi-open multi-vane.
- b. Cast iron.
- c. Statically and dynamically balanced.
- d. Key and lock to the shaft

3. Shaft Seals

- a. Mechanical seals with ceramic vs. carbon sealing faces.
- b. Stainless steel metal parts with Buna-N elastomers.
- c. Lubricated by oil-filled reservoir.

B. Motor

- 1. Submersible design, squirrel cage induction 1.15 service factor.
- 2. Housed watertight chamber.
- 3. Thrust Bearings: Ball type.
- 4. Radial Bearings: Ball type.
- 5. Stator: Class F winding rated to 310 degree F, shrink fit.
- 6. Built-in thermal overload protection.
- 7. Motors 1/2 hp and above shall be 480V, 3-phase. Motors less than 1/2 hp shall be 120V/240V, single phase.

- C. Motor Cable: Of appropriate length, severe duty rated, oil and water resistant, suitable for submersible service, and of such size that it can be used on all voltage combinations.

## 2.02 MOTOR ELECTRICAL CONTROLS

- A. Provide all equipment to allow manual and fully automatic operation.
- B. Mount 4'-6" above floor elevation adjacent to pump.

## 2.03 LIQUID LEVEL SENSORS

- A. Provide liquid level sensors with 20 feet of electrical cable each and provide a stainless steel, 2-in. dia., Sch. 40 level sensor support pipe.
- B. Construction
  1. Hermetically sealed mercury switch in corrosion resistant case.
  2. Float weighted with lead.
  3. Synthetic 3-wire cable attached to float with locked compression fitting covered with a flexible, protective boot.
  4. Cable: Heavily sheathed, severe duty rated, oil and water resistant.
  5. Operates on single phase 120/240V service.

## 2.04 PUMP SCHEDULE

- A. Design basis attached at end of this Section.

# PART 3 EXECUTION

## 3.01 EXAMINATION

- A. Verify that structure and equipment are compatible.
- B. Examine pump and appurtenances to verify equipment is complete and not damaged.

## 3.02 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations.

- B. Provide and install 2-in. diameter Schedule 40 galvanized steel pipe to support float switches, screwed on cap on top, and embed in concrete for support.
- C. Make all adjustments required to provide complete and satisfactory operation.
- D. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout.
- E. No extra compensation will be allowed for differences between actual dimensions and those shown on the Contract Drawings.

### 3.03 FIELD QUALITY CONTROL

#### A. Field Testing

1. Proof test pump discharge volume at specified head conditions.
2. The Subcontractor shall provide an accurate and acceptable method for measuring discharge flow.
3. Tests shall assure that the units and appurtenances have been installed correctly, and that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.
4. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

PUMP SCHEDULE

Location	Pump Number	Pump Capacity (GPM)	Maximum Speed (RPM)	TDH (Feet)	Voltage/Phase/Cycle
Treatment Plant Sump	P-05	5	1750	20	208/3/60
Decon Pad Sump	P-07	5	1750	30	208/3/60

END OF SECTION

SECTION 11328

LOW PROFILE DIFFUSED AERATOR

(OPTION A)

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

1.02 DESCRIPTION

- A. Furnish and install one multichambered coarse bubble diffused aeration system and stack for the removal of volatile organic compounds.
- B. The system shall contain at a minimum, but not necessarily limited to the following:
  - 1. NEMA34 control panel.
  - 2. Mounted blower.
  - 3. All necessary circuitry, alarms, level sensors and other appurtenances as shown on the Drawing and as specified in this Section.
  - 4. All equipment shall be designed for outdoor service.

1.03 PROCESS DESIGN REQUIREMENTS

- A. Capable of treating maximum flow rate of 60 gpm.
- B. Remove Volatile Organic Compounds from the groundwater and wastewater stream to EPA established Maximum Contaminant level (MCLs). See attached table at the end of this section for performance standards for this treatment system.

- C. Designed to minimize effluent vapor velocity to minimize entrained water discarded.
- D. Air Flow Rate: As required by manufacturer to achieve performance standards.
- E. Air to Water ratio: As required by manufacturer to achieve performance standards.
- F. Contact Time: As required by manufacturer to achieve performance standards.
- G. Electrical: Service available will be 480V, 3-phase and 120V/240V, single phase.

#### 1.04 QUALITY CONTROL

- A. Provide, insofar as possible, the product of one manufacturer or the equipment of one supplier; who shall assume responsibility for the proper functioning of the entire system and every component thereof.
- B. Acceptable manufacturers
- C. Continental Environmental Services
- D. Environmental Restoration Systems
- E. Ejector Systems, Inc.
- F. or approved equal.

#### 1.05 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Performance data for all constituents of concern listed in the table at the end of this section. This data shall include estimated water and vapor discharge concentrations for all constituents of concern.
- D. Shop Drawings, including electrical details showing installation details.
- E. Feed stream water quality requirements needed for efficient operation of the unit.
- F. Operation and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Tanks: Aluminum
- B. Painted steel skid.

### 2.02 CAPACITY

- A. Water Volume: As required by manufacturer to achieve performance standards.

### 2.03 BLOWER

- A. Design to be in accordance with Division 16 specifications
- B. Direct drive, fan type blower.
- C. Fan to be enamel coated for corrosion resistance.
- D. Motor to be Totally Enclosed Fan Cooled.

2.04 EFFLUENT PUMP: Specified in Section 11313 of these Specifications.

### 2.05 ACCESSORIES

- A. Skid for mounting all components, constructed from structural grade carbon steel and coated with enamel paint (minimum 5 mils dry film thickness)
- B. Dry closure low air flow switch to allow system shut down due to low air flow.
- C. Low liquid level switch located in unit sump to shut off effluent pump. Switch shall have a built-in delay for startup to minimize cycling of the pump.
- D. High liquid level switch located in unit sump to actuate high level alarm.

2.06 STACK: Shall be a minimum of 2.5 times the height of the aeration tank.

## PART 3 EXECUTION

### 3.01 INSPECTION

- A. Verify that structure and equipment are compatible.
- B. Inspect tank and separate components, verify equipment is complete and not damaged.

### 3.02 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations.
- B. Make all adjustments required to provide complete and satisfactory operation.
- C. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout.
- D. No extra compensation will be allowed for differences between actual dimensions and those shown on the Contract Drawings.
- E. Coordinate requirements with Air Sparger Feed Pump and Effluent Pump manufacturer.
- F. Provide services of the equipment manufacturer for maximum of 1 day in accordance with Section 11001, Equipment - General Requirements.

### 3.03 FIELD QUALITY CONTROL

- A. After installation of the unit and appurtenances is complete, operating tests shall be carried out at the units rated capacity for a minimum of two hours.
- B. Tests shall be performed in the presence of the Contractor.
- C. Tests shall assure that the unit and appurtenances have been installed correctly, and that all manual and automatic controls function properly.
- D. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

END OF SECTION

**TABLE 1-1  
PERFORMANCE CRITERIA**

Constituent of Concern	Est. Influent Conc. ( $\mu\text{g/L}$ )	Maximum Effluent Conc. ( $\mu\text{g/L}$ )
Benzene	5	5
2-Butanone	580	NA
Chlorobenzene	10	NA
1,4-Dichlorobenzene	12	NA
1,1-Dichloroethane	24	NA
1,2-Dichloroethane	9	5
cis-1,2-Dichloroethene	3,600	NA
trans-1,2-Dichloroethene	23	NA
1,2-Dichloropropane	6	5
Ethylbenzene	41	NA
2-Hexanone	70	NA
4-Methyl-2-pentanone	110	NA
Tetrachloroethene	3	NA
Toluene	840	NA
Trichloroethene	45	5
Xylenes (total)	120	NA
Vinyl Chloride	310	2

## SECTION 11358

### VAPOR PHASE CARBON SYSTEM

#### PART 1 GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

##### 1.02 DESCRIPTION

- A. Furnish and install a vapor phase carbon adsorption system and discharge stack for the removal of volatile organic compounds from the air sparger vapor effluent stream.
- B. The system shall contain at a minimum, but not necessarily limited to the following:
  - 1. NEMA 3R control panel or better.
  - 2. Mounted blower, B-02.
  - 3. Preheater, E-01.
  - 4. All necessary circuitry, piping, valves and appurtenances as shown on the Drawing and as specified in this Section.
  - 5. All equipment shall be designed for outdoor service.

##### 1.03 PROCESS DESIGN REQUIREMENTS

- A. Capable of treating maximum flow rate of air sparger blower (B-01), Specification 11328.
- B. Remove Volatile Organic Compounds from the air sparger vapor effluent stream to meet the discharge criteria listed in Table 11358-1 provided at the end of this section.

- C. System to include method, such as preheater (E-01), to minimize humidity of stream to carbon adsorbers. Humidity to adsorbers not to exceed 40 percent.
- D. Adsorber Size: As required by manufacturer to achieve performance standards. Portable size preferred. Adsorbers may be placed in parallel.
- E. Number of Adsorbers: As required by manufacturer to achieve performance standards.
- F. Contact Time: As required by manufacturer to achieve performance standards.
- G. Electrical: Service available will be 480V, 3-phase and 120V/240V, single phase.

#### 1.04 QUALITY CONTROL

- A. Provide, insofar as possible, the product of one manufacturer or the equipment of one supplier; who shall assume responsibility for the proper functioning of the entire system and every component thereof.
- B. Acceptable manufacturers:
  - 1. Continental Environmental Services
  - 2. Calgon
  - 3. Westates
  - 4. or approved equal.

#### 1.05 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Performance data for all constituents of concern listed in the table at the end of this section. This data shall include estimated vapor discharge concentrations for all constituents of concern.
- D. Shop Drawings, including electrical details showing installation details.
- E. Operation and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Adsorbers: Approved DOT containers.

### 2.02 CAPACITY

- A. Vapor Flow: As required by air sparger manufacturer - Specification 11528.

### 2.03 BLOWER - B-01

- A. Design to be in accordance with Division 16 specifications.
- B. Fan to be enamel coated for corrosion resistance.
- C. Motor to be Totally Enclosed Fan Cooled.

### 2.04 PREHEATER - E-01: Design to be in accordance with Division 16 Specifications.

### 2.05 ACCESSORIES

- A. Pallets, if appropriate, for placing adsorbers and blower. Or skid for mounting all components, constructed from structural grade carbon steel and coated with enamel paint (minimum 5 mils dry film thickness).
- B. Dry closure low air flow switch to allow system shut down due to low air flow.
- C. Recycle piping to provide additional air flow to adsorbers when needed.
- D. Flexible hoses to be provided to allow simplified changeout of adsorbers.
- E. Stack shall be a minimum of 2.5 times the height of the adsorbers.

## PART 3 EXECUTION

### 3.01 INSPECTION

- A. Verify that structure and equipment are compatible.
- B. Inspect adsorbers and separate components, verify equipment is complete and not damaged.

### 3.02 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations.
- B. Make all adjustments required to provide complete and satisfactory operation.
- C. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout.
- D. No extra compensation will be allowed for differences between actual dimensions and those shown on the Contract Drawings.
- E. Coordinate requirements with Air Sparger manufacturer.
- F. Provide services of the equipment manufacturer for maximum of 1 day in accordance with Section 11001, Equipment - General Requirements.

### 3.03 FIELD QUALITY CONTROL

- A. After installation of the unit and appurtenances is complete, operating tests shall be carried in conjunction with Air Sparger operations at the Spargers rated capacity for a minimum of two hours.
- B. Tests shall be performed in the presence of the Contractor.
- C. Tests shall assure that the unit and appurtenances have been installed correctly, and that all manual and automatic controls function properly.
- D. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

END OF SECTION

**TABLE 1-1  
PERFORMANCE CRITERIA**

Constituent of Concern	Est. Influent Conc. (lb/hr)	Maximum Effluent Conc. (mg/m <sup>3</sup> )
Benzene	0.00015	0.00238
Chlorobenzene	0.00030	0.27778
1,4-Dichlorobenzene	0.00036	1.07143
1,1-Dichloroethane	0.00072	0.64286
1,2-Dichloroethane	0.00027	0.03175
cis-1,2-Dichloroethene	0.10814	0.62698
trans-1,2-Dichloroethene	0.00069	0.62698
1,2-Dichloropropane	0.00018	0.27381
Ethylbenzene	0.00123	0.34524
Tetrachloroethene	0.00009	0.26587
Toluene	0.02523	0.89286
Trichloroethene	0.00135	0.21429
Xylenes (total)	0.00360	0.34524
Vinyl Chloride	0.00931	0.01032

SECTION 11394

BIOREACTOR SYSTEM

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

1.02 DESCRIPTION

- A. Furnish and install equipment, piping and valves associated with the Bioreactor System as shown on the Drawings and as specified in this Section.
- B. All equipment shall be designed for outdoor services.

1.03 SUBMITTALS

Provide three copies of each of the following.

- A. Catalog Data
  - 1. Manufacturer's literature and illustrations
- B. Manufacturer's Specifications and Engineering Data
- C. Performance Data
- D. Shop Drawings
- E. Operation and Maintenance Manuals

## PART 2 PRODUCTS

### 2.01 EQUIPMENT

Equipment described in this section shall be furnished for installation and assembly of the RBC by the contractor.

#### A. Influent System

##### 1. Influent Pump

- a. Description: Adjustable diaphragm type controlled volume Pump.
- b. Capacity: 0-2 gpm.
- c. Accessories: Back pressure valve (1/2", 316 ss with Teflon diaphragm, set at 50 psi), Calibration Column, and Calibration Column Isolation Valve.

#### B. Nutrient Delivery System

##### 1. Mixing Tank

- a. Description: 250 gallon polyethylene tank with steel support stand and 1/2" coupling in tank bottom.
- b. Dimensions: 36"D x 60"H.

##### 2. Mixing Motor

- a. Description: Mixer - 48" ss shaft, clamp-on.
- b. Power: 1/4 HP, 1-60-115v TE stock motor for outdoor use.

##### 3. Metering Pump

- a. Diaphragm pump; 316 ss with Teflon diaphragm, 6.2 gph at 100 psi discharge pressure.
- b. Power: 1/4 HP, 1-10-115/230V, TE stock motor

##### 4. Associated Valves and Fittings

- a. PVC suction strainer and fitting for tank

- b. 2 ball valves
  - c. Back Pressure Valve - ½", 316 ss with Teflon diaphragm, set at 50 psi.
  - d. Calibration column
  - e. Calibration Column Isolation Valve
- C. pH Control System
- 1. pH Electrode with mounting assembly
  - 2. Controller
  - 3. Metering Pump
    - a. Description: Positive Displacement Diaphragm pump - PP, 3.56L/hr at 58 psi back pressure.
    - b. Power: 12-200 W
    - c. Associated valves and fittings: valves and tubing (6mm OD, 4mm ID).
- D. Methane/Oxygen Control System Components
- 1. Timer
    - a. Description: Table top 4 circuit programmable timing controller (20 on/off programs, controlled devices plug into collector)
    - b. Power: 120 Vac, 60 Hz
  - 2. Solenoid Valves
    - a. Description: Direct Acting (Pilot operated), 2-way normally closed. ⅛ orifice, ¼" NPT connections, Cv = 0.315
    - b. Power: 6.5 Watt, 60 Hz - 115 Volt
  - 3. Pressure Relief Valves
    - a. Description: 4- pressure relief (check) valves, ⅓ psi nominal cracking pressure, 316 ss.

- b. Dimensions: ¼" NPT male.
- 4. Low Pressure Differential Transmitter with Switch
  - a. Description: Low pressure differential transmitter, Range = 0 to 10" of H2O, + pressure switch.
  - b. Dimensions: 2.5"H x 4.5"W x 4"D
- E. Flow Meter System
  - 1. Low Flow Sensor
    - a. Description: Low level pulse input meter with infra-red electro-optical transmitter. Include 12 V a 70mA output power.
    - b. Power: 115/230V
    - c. Dimensions: 2"H x 3.8"W x 5.9"D
- F. Water Heater System
  - 1. Heater
    - a. Description: 8" diameter pipe tank, 316 ss, 2 elements, built-in thermocouple and thermostat.
    - b. Power: 4000W, 240 V, single phase.
    - c. Dimensions: 2" NPT thread, 18" heating element.
  - 2. Heater Tank
    - a. Description: 8" diameter pipe tank, 316 ss, schedule 40, welded end plates and fittings.
    - b. Capacity: 5.2 gallons
    - c. Dimensions: 8" diameter, 24" long, (1)-2" NPT connection, (4) - ¾" welded fittings.

G. Weather Proof Box

1. Description

Furnish materials and construct cover box with sufficient dimensions to cover the Gas Analyzer. Construct frame with steel or wood with all sides and tops of plastic tarp. Tops should tilt to allow runoff. Bottom of frame to be bolted to pad. Coordinate with the Contractor for acceptance of dimensions.

PART 3 EXECUTION

3.01 INSTALLATION BY CONTRACTOR

END OF SECTION

## SECTION 11395

### MIXERS

#### PART 1 GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Measurement and Payment: Section 01025
- B. Special Project Procedures: Section 01025
- C. Shop Drawings, Project Data, and Samples: Section 01340
- D. Equipment, General Provisions: Section 11001
- E. Piping and Valves: Section 15050
- F. Electrical, General Provisions: Section 16010
- G. Electric Motors: Section 16150

##### 1.02 DESCRIPTION

- A. Furnish and install mixer(s) of the type(s) detailed in the Mixer Schedule attached to the end of this section, at locations indicated on the Drawings and as specified herein. Subcontractor shall also furnish and install any anti-vortex baffles shown on the Drawings or recommended by the manufacturer and approved on the shop drawings.
- B. Provide all necessary circuitry and appurtenances as shown on the Drawings and as specified in this Section.
- C. All equipment shall be designed for outdoor service.

##### 1.03 QUALITY CONTROL

- A. Acceptable Manufacturers
  - 1. JWI
  - 2. Philadelphia Gear
  - 3. Lightnin
  - 4. or approved equal.

##### 1.04 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Catalog Data: Manufacturer's literature and illustrations.

- B. Manufacturer's Specifications and Engineering Data.
- C. Performance Data.
- D. Shop Drawings.
- E. The mixer manufacturer shall certify in writing that he has a spare drive assembly for the size supplied available for shipment within a 48-hour period in the event of equipment break-down.

## PART 2 PRODUCTS

### 2.01 DRIVE ASSEMBLY

- A. Reaction Tank and Polymer Tank Mixers:
  - 1. Double reduction helical gearing and concentric input and output shaft design.
  - 2. The motor pinion and driven gear shall be easily removable to allow for gear ratio change to provide multiple output shaft speeds.  
Output shaft speeds: less than 290 rpm but greater than 100 rpm
  - 3. AGMA quality 10 (per AGMA 2000-A88) to provide for smooth and quiet operation.
  - 4. Efficiency: 96% minimum.
  - 5. The gear drive thermal rating shall exceed the mechanical rating to eliminate the need for external cooling.
  - 6. Designed per the applicable AGMA standards for continuous duty with a minimum service factor of 1.5 (mixer mechanical rating x motor nameplate horsepower).
  - 7. Minimum bearing B-10 life: greater than 50,000 hours.
  - 8. Permanently lubricated splash type system. Oil pumps shall not be permitted.
  - 9. The operating noise level shall not exceed 90 dBA at a distance of 3 feet from the gear drive.
  - 10. Drive Housing: Cast aluminum, heat treated for dimensional stability.

## 2.02 AGITATOR SHAFT AND IMPELLER(S)

- A. Materials of construction: 316 SS
- B. Shaft sufficiently sized to avoid dynamic instability of assembly.
- C. Impeller(s): Axial flow type, investment cast or fabricated (axial or radial) flow type and precision machined to insure smooth and vibration free operation. Secured to shaft by means of square head set screws.
- D. Lower impeller shall include a stabilizing device if shaft length exceeds 48 inches.
- E. In tank bearing shall not be allowed.

## 2.03 AGITATOR MOUNTING

- A. See Mixer Schedule attached.
- B. For vertical on center mounting, tank must include baffles, per agitator manufacturers recommendations, to prevent vortexing.

## 2.04 PAINTING

- A. All exposed steel and aluminum surfaces shall be properly prepared (by blasting and/or solvent cleaning) and painted as follows:
  - 1. One coat (6 mils dry film thickness) of high-build catalyzed epoxy primer.
  - 2. Two finish coats (6 mils dry film thickness) of two-part aliphatic polyurethane paint.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations, and make all adjustments required to provide complete and satisfactory operation.
- B. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout. No extra compensation will be allowed for differences between actual dimensions and those shown on the Drawings.

3.02 SCHEDULE

A. See Mixer schedule attached.

MIXER SCHEDULE

DESCRIPTION	MATERIAL TO BE MIXED	TANK SIZE	TANK TYPE	MOUNTING	AGITATION CLASS
Pretreatment Tank	Groundwater/ Potassium Permanganate	1500 gallon 6'Dx7'H	Vertical	4" RF Flg.	Blend
Precipitation Tank	Groundwater/Caustic/ Insoluble Solids	700 gallon 5'Dx5'H	Vertical	Side	Suspended Solids
Neutralization Tank	Groundwater/Acid	700 gallon 5'Dx5'H	Vertical	Side	Blend

END OF SECTION

*DIVISION 15*  
*MECHANICAL*

SECTION 15060

PIPING AND VALVES

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:

- A. Non-Pressure Sewer Pipe: Section 02611
- B. Hangers and Supports: Section 15140

1.02 DESCRIPTION

- A. Furnish and install all above grade project piping and valves.

1.03 REFERENCES

- A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- 1. American Society of Mechanical Engineers (ASME)

1.04 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Piping, Valves and Appurtenances.
  - 1. Catalog Data: Manufacturer's literature and illustrations.
  - 2. Manufacturer's Specifications and Engineering Data.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General
  - 1. Pipe and valve material specifications are listed in the Piping Materials Specifications - General Service Index at the end of this section.

2. Materials and components shall be in accordance with ASME B31.1, ASME specifications for PVC piping and all other applicable Federal, State, and Municipal Codes.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Fabricate, assemble and erect piping systems in accordance with ASME B31.1, and ASME specifications for PVC piping.
- B. General
  1. Install in a neat workmanlike manner.
  2. Install to elevations shown on the Drawings.
  3. Piping Support: Provide support of all piping as required by ASME B31.1 and Section 15140, Hangers and Supports.
  4. Accommodate thermal expansion and contraction of piping when supporting piping.
- C. All Horizontal Pipe Runs: Pitch to drain.
- D. At locations where ferrous and non-ferrous pipe are being joined, use dielectric bushings or unions.
- E. Valve all branch lines as close to the junction with the main line as possible with the type of valve specified in the appropriate sections of Division 15.
- F. All Exterior Buried Piping: Install as required under Division 2.
- G. Make ample clearances and allowances for all expansion and contraction of piping, mechanical equipment, and the passage of personnel without blocking aisles or work spaces.
- H. Vertical runs of piping shall be supported so that lower end fittings are not overloaded.
- I. Vertical runs shall be supported at eight-foot maximum intervals.

### 3.02 PROTECTION OF EQUIPMENT

#### A. General

1. Exercise particular care during construction and start-up to prevent foreign materials from getting into the piping systems and lodging in valves, fittings, instrumentation or other equipment.
2. Temporarily block off equipment openings with solid diaphragms until after the piping systems have been cleaned and inspected.

#### B. Cleaning

1. Inspect the interior of all equipment to establish that it is free from dirt or other foreign matter prior to its connection with the piping system.
2. The Subcontractor shall be responsible for the repair of equipment damaged by passage of such dirt or foreign matter.

#### C. Temporary Strainers

1. Install a flat screen strainer between flanges at the inlet connections of pumps and other equipment prior to initial operation as necessary to prevent damage.
2. Remove, clean and replace as directed and finally remove when the Resident Engineer is satisfied that they are no longer required.

#### D. Permanent Strainers: During the initial period of operation remove, clean, and replace the baskets of all permanently installed strainers as directed, until the Resident Engineer is satisfied that a clean system exists.

#### E. Scavenging

1. Upon completion, thoroughly clean and flush or blow out all pipe lines.
2. Furnish and install temporarily connected blow-out lines, through which water may be discharged.
3. Temporary lines required for the construction and pipe cleaning period shall be properly supported and restrained.
4. Take adequate precautions to prevent impingement of the discharge on structures or to areas where personnel might be injured.

5. When the line is clean, remove the temporary line and seal the opening in the scavenged system.
6. Provide water for washing out pipe lines.

### 3.03 EXAMINATION

- A. Examine pressure piping system and components for leaks prior to start-up.
- B. Examination shall be performed by qualified and certified personnel.
- C. Repair or remove and replace all unacceptable defects or imperfections and re-examine.

### 3.04 TESTING

#### A. General

1. Test finished work by hydrostatically testing at 1.5 times the design pressure of the piping for 10-minute period and also by an operating test under normal service conditions. Pressure shall not drop over a 10-minute period.
2. Furnish and remove the test pump and gauge, test piping connections, drains, vents, blanks, etc., where these are required.

#### B. Fluid for Tests

1. Test medium shall normally be water unless noted otherwise.
2. Furnish and dispose of test fluid at Subcontractor's expense unless noted otherwise.

#### C. Precautions

1. Properly support piping under hydrostatic test to prevent damage to its hangers and supports.

#### D. Repairs

1. At the completion of the tests, immediately make tight, to the satisfaction of the Owner, any leaks which develop under the test; correct loose or otherwise faulty hangers; and apply such devices as may be necessary to eliminate sway or vibration of pipe or supports.

2. Remove, repair, or replace any insulation or other material affected by test conditions or by leaks or other defects whether part of his work or that of others.
3. Any material or work which is defective, in the opinion of the Resident Engineer, shall be replaced by new material.
4. The Subcontractor shall be responsible for the tightness of all work made up by him and shall promptly eliminate all leaks which develop.

END OF SECTION

## SECTION 15140

### HANGERS AND SUPPORTS

#### PART 1 GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Piping and Valves: Section 15060.

##### 1.02 DESCRIPTION

- A. Furnish and install all hangers, supports and restraints shown, specified or normally required for pipe, tubing, apparatus and equipment other than electrical equipment.

##### 1.03 REFERENCES

- A. Publications listed below form a part of this Specification to extent referenced. Publications are referred to in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - 1. ASME B31.1, Code for Power Piping.
- C. American Society of Testing and Materials (ASTM):
  - 1. ASTM A 36-89, Standard Specification for Structural Steel.
  - 2. ASTM A 575-86, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
- D. Manufacturer's Standardization Society (MSS):
  - 1. MSS-SP-58, Standard Practice for Pipe Hangers and Support Materials, Design and Manufacture.
  - 2. MSS-SP-69, Standard Practice for Pipe Hangers and Supports-Selection and Application.

## 1.04 SUBMITTALS

- A. Submit Shop Drawings, data sheets and catalog information showing quantity, type, design and location of all hangers and supports required under various contract items before these items are installed.

## PART 2 PRODUCTS

### 2.01 MATERIALS, DESIGN AND MANUFACTURE

- A. Materials, design and manufacture of pipe hangers and supports shall be in accordance with ASME B31.1 and MSS-SP-58.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Select and install supports in accordance with ASME B31.1 and MSS-SP-69.
- B. Locate supports to maintain piping, apparatus, and equipment in proper position and alignment under all operating conditions and to allow for expansion and contraction of piping.
- C. In General Locate Supports:
  - 1. Adjacent to changes in direction.
  - 2. Adjacent to concentrated loads (such as valves and instrumentation).
  - 3. On both sides of flanged connections.
  - 4. At all vertical risers.
  - 5. Adjacent to equipment connections.
  - 6. Adjacent to branch connections.
  - 7. Spacing of Hangers:

a. In general, do not exceed the following:

<u>Pipe Size</u> <u>(in.)</u>	<u>Carbon Steel &amp; Wrought Iron</u> <u>Piping (ft.)</u>
1	7
1-1/2	9
2	10
2-1/2	11
3	12
3-1/2	13
4	14

b. PVC Piping Supports: Spaced according to manufacturer's recommendations.

c. Load Carrying Capacity:

- (1) Where concentrations of valves, fittings and equipment occur, closer spacing of supports will be required.
- (2) Place hangers as close as possible to concentrated loads.
- (3) In no case shall any total hanger load (weight of piping, insulation and contents) exceed the following load carrying capacities for hot rolled steel rod as specified in ASTM A 576.

<u>Nominal Rod Diameter</u> <u>(in.)</u>	<u>Maximum Safe Load</u> <u>(lb.)</u> :
3/8	610
1/2	1,130
5/8	1,810
3/4	2,710
7/8	3,770
1	4,960
1-1/8	6,230
1-1/4	8,000
1-3/8	9,470
1-1/2	11,630

E. Where a change in direction occurs between supports, total length of pipe between supports shall not exceed 75 percent of maximum span given in D. above.

F. Insulated Piping

1. Copper Tubing

- a. Provide insulation shields at support points to distribute load.
- b. Maximum Spacing Between Supports: Conform to D. above, but do not exceed 10 feet for insulated copper lines.

2. Steel Pipe

- a. Up to 2 inch Diameter: Provide insulation shields at support points.
- b. 2 ½ Inch Diameter and Larger: Use protection saddles at support points.

G. Anchors

1. Furnish and install, when specified, shown or required, for holding pipelines and equipment in position or alignment.
2. Designed for rigid fastening to structures, either directly or through brackets.
3. Design of all anchors subject to approval by Resident Engineer.

H. Provide pipe supports to minimize lateral forces through valves, both sides of split type couplings, and sleeve type couplings and to minimize all pipe forces on equipment. Do not use equipment to support connecting pipes.

I. Piping on Walls

1. Support by hangers securely anchored into the wall construction.
2. Support risers with approved clamping device, Grinnell riser or socket type, or approved equal, spaced not greater than 6 feet on centers.
3. Furnish and install backplates as required of adequate size and thickness to distribute load against wall.
4. Where use of backplates is not practicable, fasten brackets to wall in such a manner that safe bearing strength of wall will not be exceeded.

3.02 TABLES

1. See Tables 3.1, 3.2, and 3.3.

END OF SECTION

SECTION 15460

CARBON STEEL TANKS

PART 1 GENERAL

1.01 DESCRIPTION

Work included: Furnish and install carbon steel tanks complete with stands and accessories, of type, capacity and at locations indicated on the Drawings and as specified in this Section.

1.02 QUALITY CONTROL

A. Acceptable Industrial Products

1. Specialty Tank and Equipment Company  
857 Robinson Avenue  
Jackson, Florida  
(904) 353-8761

B. or approved equal.

1.03 SUBMITTALS

Three copies of each of the following shall be provided.

- A. Shop Drawings and catalog data indicating tank capacities, physical sizes, pipe connections, material, thickness, and accessories for each.

PART 2 PRODUCTS

2.01 TANKS

A. Volume as specified on the attached schedule.

- B. Constructed as flat or conical bottom, cylindrical shaped and open topped, from carbon steel equivalent to ASTM A-36-89 or better and a minimum of 1/4 in. thickness.

C. Tank to be supported externally.

- D. All structural welding shall be to the latest edition of AWS using AWS certified welders, AWS D1.1 for carbon steel. The welded areas shall be designed for coating. This requirement includes, but is not limited to, welds ground smooth, no sharp corners, and radiuses left in corners.
- E. All carbon steel surfaces shall be sandblasted in accordance with the Steel Structures Painting Council Surface Preparation ANSI SSPC SP-6 "Commercial Blasting " latest edition.
- F. Coatings:
  - 1. Interior: Minimum one coat primer and one coat epoxy. Suitable for pH range of 6 to 10. Minimum dry film thickness of 5.0 mils.
  - 2. Exterior: Minimum 2 coats epoxy factory applied. Minimum dry film thickness of 3.0 mils.
- G. Tank top rim to be reinforced with angle, steel material.
- H. Include a gasketed, hinged and bolted, (except on hinged section) cover with nozzle as indicated. Cover shall have allowance for agitator mounted on side.
- I. Tank vender or mechanical designer shall verify baffle size, number and location within vessel during final design. Vent nozzle shall be verified during final design by vender.
- J. Flat bottom tanks shall be provided with a draining toward outlet nozzle and drain nozzle.
- K. Nozzles
  - 1. Nozzles unless otherwise noted are to be 150 lbs. ASA standard raised face. Couplings are to be 3000 lbs, half couplings.
  - 2. Nozzle location and orientation shall be determined during the final design by the vender.

## 2.02 TANK STANDS

- A. Constructed entirely out of welded steel.
- B. Tank supports shall be designed to support the tank, contents and agitator.
- C. Provided with factory epoxy finish.

## 2.03 ACCESSORIES

- A. Furnish all necessary appurtenances for installation as shown on the Drawings.
- B. All elements of the tank and appurtenances shall be designed to withstand all conditions of the intended service without corrosion, undue stress or deflection.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations.
- B. Furnish and install all connecting piping, including valves, fittings and unions.
- C. Before ordering any materials or doing any work, verify all measurements concerning equipment and layout.
- D. No extra compensation will be allowed for differences between actual dimensions and those shown on the Drawings.

### 3.02 INSPECTION AND TESTING

- A. Prior to Installation
  - 1. Inspect interior and exterior of all tanks for cracks or other deficiencies which would render the tanks unsuitable for service.
  - 2. Should any deficiency be found during this inspection, repair or replace at no additional cost to the Contract.
- B. Immediately Following Installation
  - 1. Fill tank with water and allow to stand for 24 hours.
  - 2. Inspect for leaks by comparing the water level in the original tank with the water level in the tank after 24 hours.
  - 3. Should a leak be discovered, repair or replace at no additional cost to the contract price.
  - 4. The repair of any damaged tank shall be at the discretion of the Resident Engineer whose decision shall be final.

### 3.03 ADJUST AND CLEAN

Make all adjustment required to provide complete and satisfactory operation upon completion of the installation and testing.

### 3.04 TANK SCHEDULE

#### Pretreatment Tank

Dimensions: 6'Dx7'H  
Capacity: 1500 gallon  
Accessories: Baffles, Agitator, Hinged Cover  
Nozzles: Inlet - 3" - 150# - RF Flg  
Inlet - 1/2" - 150# - Male NPT  
Agitator - 4" - 150# RF Flg  
Level - 4" - 150# RF Flg  
Outlet - 2" - 150# RF Flg - placed on tank side,  
5 ft. from bottom  
Drain - 2" - 150# RF Flg

#### Precipitation Tank

Dimensions: 5'Dx4'H  
Capacity: 600 gallon  
Accessories: Agitator, Hinged Cover  
Nozzles: Inlet - 2" - 150# RF Flg  
Inlet - 1/2" - 150# Male NPT  
Level - 4" - 150# RF Flg  
Outlet - 2" - 150# RF Flg  
Drain - 2" - 150# RF Flg

#### Neutralization Tank

Dimensions: 5'Dx5'H  
Capacity: 700 gallon  
Accessories: Agitator, Hinged Cover, Tank Support  
Nozzles: Inlet - 2" - 150# RF Flg  
Inlet - 1/2" - 150# Male NPT  
Level - 4" - 150# RF Flg  
Outlet - 2" - 150# RF Flg

END OF SECTION

*DIVISION 16*  
*ELECTRICAL REQUIREMENTS*

## SECTION 16010

### ELECTRICAL, GENERAL REQUIREMENTS

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Excavation, Backfill and Compaction: Section 02221

##### 1.02 DESCRIPTION

###### A. Work Included:

1. Furnish and install the complete electrical system detailed on the Drawings and as specified in this Section, including, but not limited to:
  - a. Electrical conduits, ducts, and wiring.
  - b. Panels for lighting, controls and instrumentation.
  - c. Lighting fixtures.
  - d. Boxes, receptacles, and plates.
  - e. Electrical service and distribution.
  - f. Grounding of all conduit and equipment.
  - g. Connection to motors, alarms, and switches required by other trades.
  - h. Temporary power and light.
2. Furnish and install appurtenance or additional materials necessary for a complete and operating electrical system consistent with the design intent depicted on the Drawings, even if not specifically shown.
3. Secure and pay for all permits, inspections, tests, etc., as required by local, state, and Federal regulations.

##### 1.03 QUALITY ASSURANCE

###### A. Codes, Permits, and Inspection:

1. Manufacture, test, and install all work in accordance with applicable publications and standards of the following organizations:
  - American Society for Testing and Materials (ASTM)
  - Underwriters' Laboratories, Inc. (UL)
  - Insulated Cable Engineers Association (ICEA)
  - National Electrical Manufacturers Association (NEMA)

Institute of Electrical and Electronics Engineers (IEEE)  
American National Standards Institute (ANSI)  
National Fire Protection Association (NFPA)  
Environmental Protection Agency (EPA)  
State and Local Electrical Codes  
National Board of Fire Underwriters  
Occupational Safety and Health Administration (OSHA)  
Electrical Testing Laboratory (ETL)

2. Comply with all laws applying to electrical installations in effect in this City, Town or State; with regulations of any other governmental body or agency having jurisdiction; with regulations of the National Electrical Code where such regulations do not conflict with those laws; and with the regulations of the Electrical Utility Company supplying electrical energy to the premises.
3. Electrical Subcontractor Responsibilities:
  - a. Obtain all permits required by the ordinances of City, Town, or State.
  - b. After completion of the work, furnish to the Engineer, for the Owner, a certificate of final inspection and approval from the Inspection Bureau having jurisdiction.
  - c. Perform and/or install all work in full compliance with all requirements of the Occupational Safety and Health Act of 1970 and all amendments thereto.
4. Motors:
  - a. Unless otherwise specified, furnish electric motors with driven equipment, mounted and factory aligned.
  - b. Wiring of motors and control equipment shall be by the Subcontractor.

#### 1.04 SUBMITTALS

- A. Submit the information required for all equipment in accordance with Division 1 - General Requirements, including:
  1. Catalog Data: Manufacturer's literature and illustrations.
  2. Manufacturer's Specifications and Engineering Data.
  3. Shop Drawings.
  4. Equipment Supplier's Certification (when required).

5. Record Drawings of final approved system before final payment is made for this work.

#### 1.05 COORDINATION, INTENT AND DISCREPANCIES

##### A. Intent:

1. The Drawings are intended to indicate only diagrammatically the extent, general character, and approximate locations of the work included.
2. Exact locations must be coordinated with local conditions and with other trades.
3. Work indicated but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner.
4. Follow Drawings and this Section of the work fitted thereto.
5. All equipment shown on the Drawings is intended to be generally representative of the equipment which will be installed under this Contract, but it shall not be assumed that the Drawings indicate the specific configuration, arrangement or points of connection of the actual equipment which will be purchased.
6. The entire work provided for in this specification shall be constructed and finished in every respect in a workmanlike and substantial manner, according to the accompanying Drawings and this specification.
7. The bidder shall include in his bid, all cost required to adapt the actual equipment he intends to purchase to the general layout indicated on the Drawings and to provide a complete and operable system.
9. Typical details shown on the Drawings shall apply to each and every item of the project where such items are incorporated; details are not repeated in full on all Drawings, but the intention that such details shall be applicable in full.

##### B. Departure from the Contract Drawings:

1. Submit details of such departures and the reasons therefore as soon as practical and within 15 days after award of the Contract, to the Contractor approval.

2. No departures shall be made without signed approval of the Resident Engineer or his authorized agent.

C. Coordination:

1. The Subcontractor shall keep himself fully informed as to the size, shape, and location of all openings required for his pipes and apparatus and shall give full information to the other trades so that the openings may be built in advance.
2. It shall be the responsibility of the Subcontractor to pay all costs for sub-letting any work under this Section in order to avoid work stoppages due to jurisdictional disputes.
3. The Subcontractor shall confer with all other trades relative to the location of apparatus and equipment and select locations so as not to conflict with work of other trades.
4. Any conflict with other trades shall be referred immediately to the Engineer for resolution.
5. If interference occurs, the Resident Engineer will determine which work is to be relocated, regardless of which was first installed.

D. Discrepancies:

1. If the Subcontractor, in the course of the work, finds any discrepancies between Drawings or equipment listed and the physical conditions of the site, or any errors or omissions in dimensions or instructions given by Drawings or equipment lists, he shall immediately notify the Resident Engineer, in writing, and the Engineer shall promptly adjust the same.
2. Any work performed after such discovery, unless authorized by the Resident Engineer in writing, shall be at the Subcontractor's risk.
3. The Drawings are, in general, made to scale, but all measurements shall be taken from figured dimensions, and not by scaling.
4. Whether or not an error is believed to exist, deviations from the Drawings and dimensions given thereon shall be made only after written approval is received from the Resident Engineer.
5. The Subcontractor shall be responsible for comparing all Drawings and verifying all dimensions before laying out the work.

6. When measurements are affected by existing conditions, the Subcontractor shall take necessary field measurements and refer any differences in dimensions to the Resident Engineer.
7. Any and all errors in the work that might have been avoided by such field measurements shall be the responsibility of the Subcontractor.
8. When submitting proposal, give written notice to the Resident Engineer of any materials or apparatus in violation of laws, ordinances, rules or regulations of all authorities having jurisdiction, and notice of necessary items of work omitted.
9. If the Subcontractor fails to give such written notice, it shall be assumed that he has included cost of all items in his proposal, and he shall be held responsible for satisfactory functioning and approval of the entire installation without extra compensation.

#### 1.06 TEMPORARY LIGHT AND POWER

- A. See Section 01510, Temporary Facilities
- B. Furnish, install and remove the temporary electrical power and lighting systems and pay for all labor, materials and equipment required therefore and for all electricity consumed until final completion. All such temporary electrical work shall meet the requirements of the National Electrical Code, the local utility company and OSHA.
- C. Make all necessary arrangements with the local utility company for temporary electric service.
- D. Secure and pay for all required permits, certificates, notarizations, back charges for work performed by others, and other expenses incidental to the installation of the temporary electric service.
- E. Provide temporary electric service for the offices of the Subcontractor until such time as the removal of these offices is ordered by the Resident Engineer.
- F. Remove and replace (furnish) all lamps installed in permanent lighting fixtures and used as temporary lights during the construction periods before completion by the set of lamps required to be furnished and installed under the Contract.

#### 1.07 NAMEPLATES

- A. Furnish and install engraved black laminated phenolic nameplates with white core for all panelboard, main service switchboard, motor starters, disconnects, control stations, etc., as indicated or required.
- B. Secure nameplates to units by screws.
- C. Adhesive units are not acceptable.
- D. Nameplates for equipment other than distribution equipment shall state which unit it is for.

#### 1.08 EQUIPMENT FINISHES

- A. All finishes shall be in good condition at the completion of the job.
- B. If finishes are damaged, restore paint on all cabinets and enclosures by complete repainting if necessary.

#### 1.09 SERVICES OF MANUFACTURER'S REPRESENTATIVES

- A. The Subcontractor shall arrange for the equipment manufacturer to furnish the services of a qualified representative as necessary to check and supervise installations, to supervise its initial operation, and instruct operators in operation and proper maintenance.

#### 1.10 TESTING

- A. General:
  - 1. Demonstrate by conducting a test that the electrical system functions and performs as required to meet the needs of the Contractor, and in accordance with the Drawings and specifications.
  - 2. Furnish personnel and calibrated instruments required for the tests. Owner shall furnish power.
  - 3. Schedule tests at a time acceptable to the Subcontractor and Contractor.
  - 4. Take ammeter and voltmeter readings of all process motors when the motors are operating under maximum design system loads.
  - 5. Clean and dry motors, contacts, relays, bus, insulators and other electrical apparatus if required.

6. Prior to applying voltage to any apparatus or circuit, make insulation resistance tests and, if necessary, dry the apparatus until resistance values conform to the standards of IEEE.
7. In drying out, use methods such that the insulation temperature of the apparatus does not exceed 90 deg.C.
8. In case of a low resistance circuit insulation, eliminate the problem before the circuit is energized.
9. Make a recheck after apparatus is dry.
10. Record all insulation values and furnish to the Engineer for review.
11. Prior to the start of check-out and testing, ensure that all equipment is properly and permanently identified.
12. Before energizing any electrical equipment or apparatus, check and verify that no tools, filings, foreign matter or other materials is left inside equipment or enclosures, particularly, bus conductors, conductor, terminal blocks and windings.
13. Check screw and bolt connections and terminal connections for tightness prior to final tests and energization.
14. Check the bearings of all rotating electrical apparatus and, if required, fill with the grease or oil as recommended by the manufacturers.
15. Provide 500 and 1000 V "megger" insulation testing during the construction and check-out period.
16. Megger motors and feeder cable from the starters prior to energizing and at the time of final checkout.
17. "Bump" 3 phase motors and reverse the connections as required to ensure proper rotation.
18. Test all main grounding loops and major equipment grounds to remote earth or directly referenced to an extremely low resistance (approximately 1 ohm) reference ground benchmark.
19. Record, witness, and report ground test results to the Owner's Representative.
20. Make tests with ground testing ohm meter or "megger."

21. Measure ground resistance of the individual networks at 2 points with cables at all the test points disconnected.
22. Reconnect the cables at the test points and make a duplicate set of ground resistance measurements.
23. Resistance shall not exceed 5 ohms.
24. Drive additional ground rods, if necessary.
25. Check all control circuits to see that their operation and sequence are correct.
26. Adjust any adjustable switches such as float switches, limit switches and timers for proper operation.
27. Prior to acceptance of the lighting facilities, clean all lighting fixtures and relamp those used for temporary lighting at no additional cost to the Contractor.
28. At no additional cost to the Contractor, promptly replace all electrical equipment, wiring, switches, insulators, etc., found to be defective or to have failed.

#### 1.11 GUARANTEE

- A. The Subcontractor shall and does hereby warrant and guarantee that all work executed under this Section will be free from defects of materials and workmanship for a period of 1 year from the date of acceptance.
- B. The Subcontractor shall further warrant that all materials furnished and work executed are in accordance with all applicable laws and regulations.
- C. Subcontractor's guarantee for items furnished under Division 16 covers and includes:
  1. Faulty or inadequate design.
  2. Improper assembly or erection.
  3. Defective workmanship and materials.
  4. Leakage, breakage, or other failure.

END OF SECTION

## SECTION 16050

### BASIC ELECTRICAL MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Work Included: Furnish and install basic electrical materials, including, but not limited to, conduit, wiring, fittings, boxes, switches, and duct as shown on the Drawings and as specified in this Section.

##### 1.02 ACCEPTABLE MANUFACTURERS

A. Metallic Conduit:

1. Republic Steel Co.
2. Allied Tube & Cond. Corp.
3. Wheatland Tube Co.
4. National Electric Products
5. Or approved equal

B. PVC conduit.

1. R&G Sloane Mfg. Co.
2. Ashland Chemical Co.
3. Carlon
4. Or approved equal

C. Liquid Tight Flexible Metal Conduit:

1. Sealtite
2. Or approved equal

D. Copper Wire:

1. Pirelli
2. Okonite
3. Cablec
4. Rome Cable
5. Southwire
6. BIW
7. Or approved equal

E. Fittings, Boxes, Wall Cases, Plates, Bushings, Lock nuts, Hangers, Bars, and Related Equipment:

1. General Electric
2. O-Z Electrical
3. Raco
4. Steel City
5. Thomas & Betts
6. Gedney
7. Kindorf
8. Meyers
9. Or approved equal

F. Cast Fittings, Conduits, and Boxes for Exposed Work:

1. Appleton
2. Crouse-Hinds
3. Killark
4. Pyle-National
5. Or approved equal

G. Switches, Receptacles, Bodies, and Plates:

1. Arrow-Hart
2. Bryant
3. General Electric
4. Hubbell
5. Pass and Seymour
6. Or approved equal

## PART 2 - PRODUCTS

### 2.01 MATERIAL

A. Exposed Conduit:

1. Rigid galvanized steel or PVC coated rigid aluminum heavy wall of standard trade size, per National Electrical Code or as specified on Drawings.
2. Each length shall have one coupling and a plastic thread protector, and shall bear the approval stamp of Underwriter's Laboratories.
3. Do not use conduit smaller than 3/4 in.

- B. Embedded Conduit:
  - 1. At least 3/4-in. diameter PVC and rigid or intermediate hot-dipped galvanized steel.
  - 2. EMT not permitted.
- C. Underground Conduit: PVC electrical conduit with cemented joints allowed, meeting requirements of ASTM D 1785, ASTM D 2241, and ASTM F 512 or rigid or intermediate metal conduit or as direct burial cable.
- D. Liquid Tight Flexible Metal Conduit:
  - 1. Furnished with an oil-resistant, liquid tight PVC jacket in combination with flexible metal reinforcing tubing, and designated for use with waterproof fittings.
  - 2. Install an equipment bonding jumper for all liquid tight conduit up to and including 1-1/4 inch.
- E. Ensure that all conduit systems are electrically continuous.
- F. Wiring:
  - 1. As shown on the Drawings, or as required by the National Electric Code.
  - 2. Copper, Type XHHW, Type THWN
- G. Conduit Fittings:
  - 1. Form 8 Feraloy or Form 9 cast aluminum alloy with gasketed cover.
  - 2. Use PVC coated fittings with PVC coated conduit.
  - 3. Use fittings one size larger fitted with reducing bushings for 2-in. and larger.
- H. Outlet Boxes (Internal Volume Less than 100 cu. in.):
  - 1. Outdoors:
    - a. Use cast ferrous alloy or cast aluminum with internal threaded hubs and cast metal, gasketed covers.
    - b. Use boxes of the same material as conduit connected to them.

- I. Junction and Pull Boxes (Internal Volume Greater than 100 cu. in.):
  - 1. Outdoors or in Perpetually Wet Areas:
    - a. Fabricate boxes from aluminum or galvanized steel painted inside and out.
    - b. Use boxes of the same material as conduit connected to them.
    - c. Use welded construction with screw-on, gasketed covers.
    - d. Make boxes rain tight when located outdoors.
    - e. Conduit Entry:
      - (1) Myers "Scru-tite" hubs or approved equal through field-punched holes; knockouts not acceptable.
      - (2) Enter through box bottom or sides wherever practical (not through top).
    - f. Furnish with ECD drain fitting in box bottom.
- J. Special Boxes: In corrosive areas, NEMA 4X, 316 SS.
- K. Bushings and Clamps:
  - 1. Bushings:
    - a. Plastic insulating type for conduit 2-in. diameter and smaller.
    - b. Insulated metallic type for conduit over 2-in. diameter.
    - c. Ground Bushing: Insulated metallic type with set screw and large lug connecting screw.
  - 2. Clamps: Aluminum or galvanized malleable iron.
- L. Switches, Receptacles, Bodies, and Plates:
  - 1. Single-Pole: Switches equal to Arrow Hart #1991-I or Hubbell #1221.
  - 2. Switch-Pilot Lights: Equal to Arrow-Hart #2991-I or Hubbell #1221-IL.

3. Safety Switches: Meet NEMA Specifications for Type HD, and be UL approved, fusible, with UL approved standard one time fuses, except as noted or specified elsewhere.
  4. Duplex Receptacles: 20A, 125V, AC/DC equal to Hubbell #5362.
- M. Other Equipment, Lighting Fixtures and Special Devices Not Listed Above: Listed elsewhere in the Specifications, or indicated on the Drawings.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### A. Conduit:

1. Cut conduits square, and ream cut ends carefully to remove burrs.
2. Install with a minimum of bends or offsets.
3. Use factory made bends for 1-in. trade size and larger.
4. Field Fabricated Bends:
  - a. Free of indentations or elliptical sections due to improper fabrication.
  - b. Make bends in metallic raceways while "cold." In no case heat raceways.
  - c. Bend raceways not more than 90 degrees.
  - d. Radius of Bends:
    - (1) Not less than required by the NEC.
    - (2) For groups of conduits, either concentric radii or equal radii bends may be used as long as the method used is consistent in any given area.
5. Use UL approved rain tight and concrete-tight connectors and couplings.
6. Protect terminations from mechanical injury and against entry of moisture and foreign matter into the conduit system by properly capping terminations.

7. Install exposed conduits parallel and group together where possible.
8. Support long "drops" of small conduit by structure or several drops tied together to provide rigid, straight, plumb and neat appearing installation.
9. Furnish and set in place all sleeves, etc., for exposed risers and inserts for raceway supports.
10. Use ells for the top bend of vertical conduit runs longer than 5 ft. In all cases cable rises shall be governed by Section 300-19 of the NEC.
11. Supports for Conduit Runs:
  - a. Conduit straps, pipe hangers or structural steel members.
  - b. Conduits of 1-1/2-in. diameter and less may be supported by 1-hole conduit straps on concrete, tile or steel work, but for larger size conduit, use 2-hole straps.
  - c. Use galvanized or aluminum Kindorf bar hangers as required for conduit supports.
  - d. In general, run conduit on top of Kindorf or other supports.
  - e. Use angle iron brackets for conduit supports around heavy vibration areas and extreme corrosive areas.
  - f. Corrosive Areas: Use steel supports with a chemical resistant PVC coating.
  - g. Do not attach to or support by wooden plug anchors or mechanical work such as duct work and piping.
  - h. Use Kindorf hangers or angle iron brackets to support conduits grouped together.
  - i. Support horizontal and vertical runs of conduit at intervals of not more than 8 ft., except for conduit 1-in. or smaller, which shall be supported every 5 ft. Larger conduits in a rack may be used for this purpose.
  - j. Install stiffener supports on corners, offsets, and intermittently in runs to eliminate flexibility.
  - k. Standard Minimum Conduit Spacing: 3/4-in.

- l. Racks: Sufficiently strong so that channel deflection under fixed load will not exceed 1/360 of the span.
  - m. Hanger Rods: 1/2-in. or larger, with load limited to 1,000 lbs. for 1/2-in. and 2,000 lbs. for 5/8-in. rods.
  - n. Angle clips may be welded to steel beams where practical. Furnish and install 1/2-in. or larger Phillips "Red Head" cinch anchors in all other areas.
12. Expansion Joints:
- a. In long straight runs, install bonding straps to insure ground continuity every 100 ft. for aluminum conduit and every 200 ft. for steel conduit.
  - b. Use expansion fittings where conduit crosses expansion joints.
13. Perpetually Damp and Wet Locations:
- a. Prevent the contact of aluminum conduit with other heavy metals.
  - b. Separate iron clamps or hangers from the conduit by means of insulating tape or paint.
14. Use Meyers "Scrutite" watertight fittings or approved equal where conduits enter wall mounted control cabinets, safety switches, circuit breaker enclosure, motor control centers, or individual motor controllers not having threaded hubs.
15. Where conduit enters outlet boxes, pull-boxes or other enclosures not included in Subparagraph 17 above, use a double lock nut and bushing assembly.
16. Wherever a cluster of 4 or more raceways rise out of the floor exposed, provide neatly formed 6-in. high concrete envelope with chamfered edges around raceways.
17. Adequately support concealed raceways above hung ceilings. Furnish all necessary steel supports where the furring structure is inadequate for support of raceways, fixtures and equipment.
18. Runs in slabs shall be installed to avoid trapping wherever possible and with as few bends as possible.

19. Aluminum conduit shall not be installed in concrete.
  20. Twisted tie wires are not adequate supports; approved clamps shall be used.
  21. Provide continuous grounding between all outlets and established electrical ground system.
  22. If non-metallic conduit is used, run a ground conductor in all conduits carrying power or lighting circuits.
  23. Install explosion-proof fittings and use conduit seals in all hazardous areas and as noted on Drawings.
  24. Install a #14 AWG fish wire in telephone, intercommunication "Spare" or "Empty" conduit runs.
  25. Plug conduits in raceways with cap or disc when roughed-in.
  26. Underground Conduit:
    - a. At least 24 in. below finished grade and at least 48 in. under road and pavement.
  27. Flexible Metal Conduit:
    - a. Use liquid-tight flexible conduit in all wet or damp locations.
    - b. Maximum length: 36 in., except that from outlet boxes to lighting fixture maximum length - 6 ft.
- B. Wire and Cable:
1. Conductor Sizes: As indicated on the Drawings but in no case smaller than indicated below:
    - a. Power circuits - #12 AWG
    - b. Lighting and receptacle circuits - #12 AWG
    - c. Control circuit wire for motor control - #14 AWG
    - d. Instrumentation - #16 AWG
    - e. Programmable controller I/O within panels - #16 AWG

2. Stranded Wire and Cable Connections:
  - a. Make power cable connections for wire sizes #10 AWG and larger, where bolted terminations are utilized, with solderless tinned copper compression type connectors.
  - b. Connectors shall be formed high-conductivity copper, securely fastened with tools recommended by connector manufacturer, Burndy, or approved equal.
3. Control Connections:
  - a. Make with compression-type fork tongue copper lugs with insulating sleeve.
  - b. T&B "Sta-Kon," or approved equal, T&B approved compression tool.
4. Install wire and cable in conduit or other type raceway systems in accordance with the Drawings and the National Electrical Code.
5. Do not install wire or cable in any section or area until the conduit or cable tray system in that section or area is completed.
6. Clean conduit of all foreign matter before wire is pulled in conduit or tray system.
7. Do not use mechanical means to pull conductors No. 8 or smaller.
8. Use of lubricants, other than talc powdered soapstone, or nonhardening compounds approved by the Underwriters' Laboratories and the cable manufacturer for pulling, is not permissible.
9. Provide suitable slack in wire or cable in boxes, outlets and cabinets to insure that there is no binding at the bushing.
10. Provide enough slack on motor leads in starter to permit the use of a "clamp-on" ammeter on any leg.
11. All wires shall be continuous, having no splices from terminal to terminal, unless otherwise indicated on the Drawings.
12. Identify all wire and cable, other than lighting branch circuits, at termination and splice points. Use the same wire number or circuit number as shown on the Drawings, wiring schedules, or connection

diagrams. Identify all wires and cables with RayChem TMS wire marking system. Wire color shall conform with diagrams where noted.

13. Branch circuit wiring to outlets, receptacles, and fixtures shall conform strictly to the branch circuit numbers on each outlet on the Drawings.
14. Wiring Splice or Tap Insulation:
  - a. For 600 V insulated wire smaller than No. 8, use 3M Scotchlock and then apply 4 half laps of Scotch #88 plastic tape or approved equal.
  - b. For 600 V and less with wire sizes #8 AWG and larger, use compression terminators, 4 half laps of non-sticky varnish cambric tape, and 2 half laps of Scotch #88 tape or approved equal.
15. Make splices and terminations in cable rated at 600 V in accordance with the manufacturer's recommendations, using materials furnished by the cable manufacturer.
16. AC Motor Terminations:
  - a. Wire Sizes #10 AWG and Smaller: Use Scotchlock connection and 4 half laps of Scotch #88 tape or approved equal.
  - b. Wire Sizes #8 AWG and Larger: Use compression terminators, 4 half laps of non-sticky varnish cambric tape, and 2 half laps of Scotch #88 tape or approved equal.
  - c. The above are minimum requirements. Apply additional taping where the above do not meet good practice or manufacturer's recommendations.
17. Wiring in Panelboards, Cabinets, etc:
  - a. Neatly formed, grouped, and tied to provide a neat and orderly appearance in the cabinet.
  - b. Use plastic wiring duct where practical.
18. Use cast connections, Cadweld or Thermoweld, for ground conductors.
19. Make all splices and connections in accessible boxes and cabinets only.

20. On termination at branch circuit outlets, leave a minimum of 8-in. free conductor for installation of devices and fixtures.
21. Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together.
22. For parallel sets of conductors, match lengths of conductors.
23. Bind together branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels using "Ty-Raps" or equivalent.
24. Provide conduit seals and explosion-proof devices as indicated on the Drawings and as dictated by the National Electrical Code for all hazardous locations indicated on the Drawings.
25. In general, lighting shall be as located on the Drawings, however, where conflicts exists, locate lights for best distribution.

C. Instrumentation and Low Level Signal and Control Wiring:

1. Install instrument transmission signal wiring as a Class 3 circuit under Article 725 of the National Electrical Code.
2. Run signal cable in galvanized steel conduit.
3. Run instrument cables in conduit or cable tray to be furnished and installed as specified in this Section and as indicated on the Drawings. Analog and digital signals will not be separated by barriers in the cable tray.
4. Shielded instrument analog and digital signal cables may be placed in the same tray or conduit.
5. Instrument transmission signal cable shield shall be carried continuously through to the designated panel where all shields shall be connected to a ground. Ground shields only at this point unless otherwise directed by instrument manufacturer's instructions, which shall be followed.

D. Special Cables:

1. Terminate and connect special cables as shown on the Drawings.

E. Outlet Boxes:

1. Consider location shown on Drawings as approximate only.
2. Locate outlet so that when fixtures, motors, cabinets, equipment, etc. are placed in position, outlet will serve its desired purpose.
3. Prior to installation, relocate any outlet location a distance of 5 ft. in any direction from location indicated on Drawings if so directed by the Engineer at no additional cost to the Owner.
4. Where outlets at different mounting heights are indicated on Drawings adjacent to each other (due to lack of physical space to show symbol on Drawings), install outlets on a common vertical line.
5. Size to accommodate the wiring device(s) to be installed.

F. Junction and Pull Boxes:

1. Install in readily accessible locations.
2. Do not block access to boxes by equipment, piping, ducts, and the like.
3. Provide all necessary junction or pull boxes required due to field conditions and as required by the National Electrical Code.

G. Hangers and Supports:

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, pendant-mounted lighting fixtures, etc.
2. Panelboards, Cabinets, Large Pull Boxes, Cable Support Boxes and Starters:
  - a. Secure to floor slab and do not support from conduits.
  - b. Small panelboards, etc., may be supported on walls.
  - c. Secure racks for support of conduit and heavy electrical equipment to building construction by substantial structural supports.

END OF SECTION

## SECTION 16150

### ELECTRIC MOTORS

#### PART 1 - GENERAL

1.01 RELATED DOCUMENTS: The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Shop Drawings, Project Data, and Samples: Section 01340
- B. Equipment, Division 11

#### 1.03 ACCEPTABLE MANUFACTURERS

- A. General Electric
- B. Westinghouse
- C. Reliance Electric
- D. Gould, Inc.
- E. Siemens
- F. Louis Allis
- G. or approved equal.

#### 1.04 SUBMITTALS

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Shop Drawings.
- D. Equipment supplier's written report certifying that equipment:
  - 1. Has been properly installed and lubricated.
  - 2. Is in accurate alignment.
  - 3. Is free from undue stress imposed by piping or mounting bolts.
  - 4. Has been operated under full load conditions and that satisfactory operations has been obtained.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. General

1. A listing of motors is shown on the Drawings.
2. Sufficient capacity to operate the driven equipment under all conditions of operation without loading beyond the rated nameplate current or power. Motors should be capable of driving their loads without encroaching on their motor service factor.
3. The rating of the motors offered: In no case less than the H.P. stated in Division 11 specification.
4. Unless specified otherwise, furnish by the manufacturer of the driven equipment, factory mounted and aligned to the equipment.

#### B. Electric Motors - Types:

1. Voltage Rating: As specified on the Drawings.
2. Single Phase Motors: Supplied with integral thermal overload protectors and auxiliaries to provide satisfactory starting characteristics except when motor starters with overload protection are provided.
3. Multi-speed Motors: Separate winding for each speed unless otherwise specified or approved.
4. Type Construction, Unless Otherwise Specified: Suitable for outdoor installation.
  - a. Totally enclosed, fan cooled or non-ventilated, rated continuous, 40°C ambient.
  - b. Explosion proof, complying with all requirements for hazardous locations as started by the National Electric Code for Class 1 Division 1, Group D locations, required only where specified.
5. All motors below 1/2 hp shall be 120 or 240V, single phase.

#### C. Voltage and Frequency:

1. Operate successfully at rated load under the following variations from rated frequency and voltage, unless otherwise specified or approved.
  - a. Variation in voltage, up to 10 percent of rating.
  - b. Variation in frequency, up to 5 percent of rating.
  - c. Variation in voltage and frequency combined, up to a total of 10 percent of ratings.

D. Electrical Motor Design

1. In accordance with the approved practice of loading manufacturers.
2. Motor Windings: Treated with an approved insulating material for protection against moisture and slightly acid and alkaline conditions.
3. Bearings: Anti-friction type unless otherwise specified.
4. As far as possible, all motors furnished under one contract shall be of the same manufacturer.

END OF SECTION

SECTION 16155  
MOTOR STARTERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Shop Drawings, Project Data, and Samples: Section 01340
- B. Equipment: Division 11

1.03 DESCRIPTION

- A. Work Included
  - 1. Furnish and install motor starters as specified in this section and as shown on the Drawings.

1.04 ACCEPTABLE MANUFACTURERS

- A. Westinghouse Electric
- B. General Electric
- C. Allen Bradley
- D. Square D
- E. Cutler-Hammer
- F. Crouse-Hinds
- G. Appleton Electric
- H. Killark Electric
- I. Furnse
- J. or approved equal

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Magnetic Starters
  - 1. Magnetic type combination starters, line voltage type with circuit breaker lockable in the "off" position.

2. Overload Relays: Furnish on each hot leg of the starter.
  3. Enclosures: 4 Outdoor Use.
- B. Automatic control devices such as thermostats, float or pressure switches, relays or contactors may control starting and stopping directly, provided they are designed specifically for that purpose, with motor rated contacts at the specified voltage.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install in locations as shown on Drawings.
- B. When motors are capable of being operated, test starters and overloads.
- C. Submit manufacturer's selection chart for overload relays for information (Contractor to select overloads per applicable manufacturer's instructions).

### 3.02 IDENTIFICATION

- A. Properly identify all motor starters in accordance with the Drawings.
- B. Identification via white lamicaid plate with black lettering.
- C. Identification to include:
  1. Load served, by name as indicated on Drawings.
  2. Equipment designation number, if any.
  3. Phase (single or three) and voltage.

END OF SECTION

SECTION 16182  
CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Electrical, General Requirements: Section 16010

1.02 ACCEPTABLE MANUFACTURERS

- A. Westinghouse Electric
- B. General Electric
- C. Square D
- D. ITE
- E. Appleton Electric
- F. Crouse-Hinds
- G. Killark Electric
- H. or approved equal

PART 2 PRODUCTS

2.01 MATERIALS

- A. Rating and number of poles as shown on the Drawings.
- B. Minimum interrupting rating of 42,000 amperes interruptable current (AIC) at 277/480V and 22,000 AIC at 120/240V AIC, unless otherwise noted.
- C. Enclosures: NEMA 1 General purpose; 12 Industrial type: 3R or 4 Outdoor use; or 7 Hazardous location unless otherwise noted on the Drawings.
- D. Bolt-in type, capable of being padlocked in the off position.
- E. Provide GFI breakers for outdoor receptacles.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in location indicated on Drawings, or if not indicated locate adjacent to equipment being controlled.
- B. Provide backer material of 3/4-inch finished grade, sanded plywood where necessary for proper installation.

END OF SECTION

## SECTION 16450

### GROUNDING

#### PART 1 - GENERAL

##### 1.01 RELATED WORK SPECIFIED ELSEWHERE:

- A. Electrical, General Requirements: Section 16010

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Size of Main Grounding Conductor: #2 bare stranded copper, minimum.
- B. Provide grounding conductors from ground electrodes to equipment as shown on the Drawings.
- C. Use 3/4 in. x 10 ft copperweld ground rods for direct burial.
- D. Do not use conduit as the ground and/or bonding conductor.
- E. Bond ground terminal of receptacles to ground conductor and outlet boxes with #12 AWG green insulated wire.
- F. Flexible metallic conduit suitable for grounding service.
- G. Ground conduit system and neutral conductor of wiring system with a connection at the main electrical service switchboard.

#### PART 3 - EXECUTION

##### 3.01 INSTALLATION

- A. Make connections to ground rods with an exothermic welding process.
- B. Mechanical connections may be made at equipment only.
- C. Ensure that a ground loop is not formed between equipment ground in electrical conduit and grounding electrodes directly connected to ground electrodes.
- D. Equip exposed "pigtailed" or grounding electrodes with an armored sheath.

- E. Group and bond ground wires to panel boxes, light fixtures, receptacles, etc., not to system neutral.
- F. Ground exterior pole-mounted lighting fixtures.
- G. Make connection to water main with a suitable ground clamp or lug connection, or if flanged pipes are encountered, make connection with lug bolted to flange connections.
- H. Motor operated water pumps shall be grounded in accordance with the National Electrical Code. Where pump and motor bases are separate, both shall be grounded.
- I. Ground Resistance Testing:
  - 1. Measure ground resistance with bridge type meter designed for testing grounds.
  - 2. Record readings, conditions of soil, model of meter, date, and name of tester.
  - 3. Conduct test in presence of Contractor. The test shall be made no less than 48 hours after a rain.
  - 4. Do not conceal conducting components until tested and accepted by Contractor.

END OF SECTION

## SECTION 16460

### DRY TYPE TRANSFORMERS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. **RELATED DOCUMENTS:** The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Shop Drawings, Project Data, and Samples: Section 01340

##### 1.03 DESCRIPTION

- A. Work Included
  - 1. Furnish and install dry type transformers as specified in this Section and as shown on the Drawings.

##### 1.04 ACCEPTABLE MANUFACTURERS

- A. Westinghouse
- B. General Electric
- C. Hevi-Duty
- D. Squene D
- E. or approved equal

##### 1.05 SUBMITTALS

- A. Catalog Data: Manufacturer's literature and illustrations.
- B. Manufacturer's Specifications and Engineering Data.
- C. Performance Data.
- D. Shop Drawings.
- E. Operation and Maintenance Manuals.
- F. Equipment supplier's written report certifying that equipment:

1. Has been properly installed and lubricated.
2. Has been operated under full load conditions and that satisfactory operation has been obtained.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Comply with NEMA Standards STI-4, TR-1, and TR-278 and ANSI Standard 4c89.19.
- B. Insulation Systems: Based on a 40 deg C ambient temperature.
- C. Meet the standard NEMA sound levels. Use NEMA-3R enclosure.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install with adequate clearances for proper ventilation.
- B. Install in locations indicated on the Drawings.
- C. Provide supports as required.
- D. Suitable for outdoor installation.

END OF SECTION

*APPENDIX A*  
*PERMITS TO BE FILED*

# SUBBASE EXCAVATION PERMIT REQUEST

MEETINGS: TUESDAY & THURSDAY TIME: 0900  
 PLACE: BLDG. 2025 (USS HENRY CLAY)  
 ROICC/CON REP: \_\_\_\_\_  
 PHONE: \_\_\_\_\_

EXCAVATION PERMIT NO. \_\_\_\_\_  
 DATE RECEIVED: \_\_\_\_\_  
 DUE ON OR BEFORE: \_\_\_\_\_  
 APPLICANT AT MEETING DATE: \_\_\_\_\_

APPLICATION DATE: \_\_\_\_\_ CONTRACT/WORK REQUEST #: \_\_\_\_\_

APPLICANT: \_\_\_\_\_ PHONE: \_\_\_\_\_ TIME TO CALL: \_\_\_\_\_

LOCATION OF APPLICANT: \_\_\_\_\_ LEAD SHOP: \_\_\_\_\_

PLEASE LIST BEEPER AND/OR MOBILE PHONE # \_\_\_\_\_

\_\_\_\_\_ INFORMATION ON EXCAVATION \_\_\_\_\_  
 ((DRAWING OF EXCAVATION SITE SHALL BE ATTACHED))

EXCAVATION PERMIT REQUEST FROM DATE: \_\_\_\_\_ TO DATE: \_\_\_\_\_

LOCATION: \_\_\_\_\_

SCOPE OF EXCAVATION:(SPECIFY PURPOSE,LENGTH AND DEPTH OF AREA) \_\_\_\_\_

## UTILITIES APPROVAL

	UTILITY			UTILITY	
	FLAGGED	NOT IN AREA		FLAGGED	NOT IN AREA
ELECTRICAL A11203	_____	_____	ATLANTA GAS	_____	_____
PLUMBING A07203	_____	_____	CAMDEN TELEPHONE	_____	_____
TELEPHONE A14203	_____	_____	CATV	_____	_____
THERMAL A10203	_____	_____	FUEL LINES	_____	_____
WATER A12203	_____	_____			
WASTEWATER A13203	_____	_____			

APPROVED BY: \_\_\_\_\_  
 APPROVED DATE: \_\_\_\_\_

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

CHARGE # \_\_\_\_\_ GRID # \_\_\_\_\_ TASK CODE : B003

**BASE HOUSING:**

REQUESTOR MUST INITIAL UPON RECEIPT OF INFORMATION.

\_\_\_\_\_ 1. MILITARY SPONSOR MUST ATTEND MEETING.

\_\_\_\_\_ 2. EXPLANATION OF EXCAVATION PROCEDURE GIVEN TO REQUESTOR.

\_\_\_\_\_ 3. EXPLANATION OF WATER JETTING GIVEN TO REQUESTOR.

## UTILITY CONNECTION/OUTAGE/MANHOLE-VAULT ENTRY/HOT WORK PERMIT REQUEST

1. FROM	2. TELEPHONE NO.:	3. TO
		NAVAL SUBMARINE BASE (CODE NS)

4.	5. SIGNATURE	6. TELEPHONE NO.:

7. TYPE REQUEST ("X" APPROPRIATE)				
TEMPORARY CONNECTION	PERMANENT CONNECTION	OUTAGE	HOT WORK	MANHOLE/VAULT ENTRY

8. TYPE UTILITY	9. CONTRACT NUMBER: (If Applicable)

10. JUSTIFICATION

11. LOCATION

12. DATE/LENGTH OF REQUESTED OUTAGE					
a. FROM			b. TO		

(1) FIRST CHOICE	(a) DATE	(b) HOUR:	(1) FIRST CHOICE	(a) DATE:	(b) HOUR.
(2) SECOND CHOICE	(a) DATE	(b) HOUR	(2) SECOND CHOICE	(a) DATE.	(b) HOUR

13. REMARKS

WHEN OUTAGE IS COMPLETED, FILL IN ITEM 14 & 15 AND RETURN COPY TO N522

14. SIGNATURE	15. DATE	16. COPY TO N522

17. FROM	18. TELEPHONE NO.:	19. TO
NAVAL SUBMARINE BASE (CODE NS)		

20.	<input type="checkbox"/> The above connection/Hot Work permit is not approved. <input type="checkbox"/> Requested outage will not be made available.	<input checked="" type="checkbox"/> THE ABOVE MANHOLE/VAULT ENTRY IS NOT APPROVED
-----	---	---

21.	<input type="checkbox"/> The above connection/Hot Work permit is approved <input type="checkbox"/> Request outage will be made available as follows:	<input checked="" type="checkbox"/> THE ABOVE MANHOLE/VAULT ENTRY IS APPROVED
-----	---	---

a. FROM:		b. TO	
(1) DATE	(2) HOUR	(1) DATE.	(2) HOUR

22. SIGNATURE	23. DATE	24. COPY TO. N52 N54 BOSC